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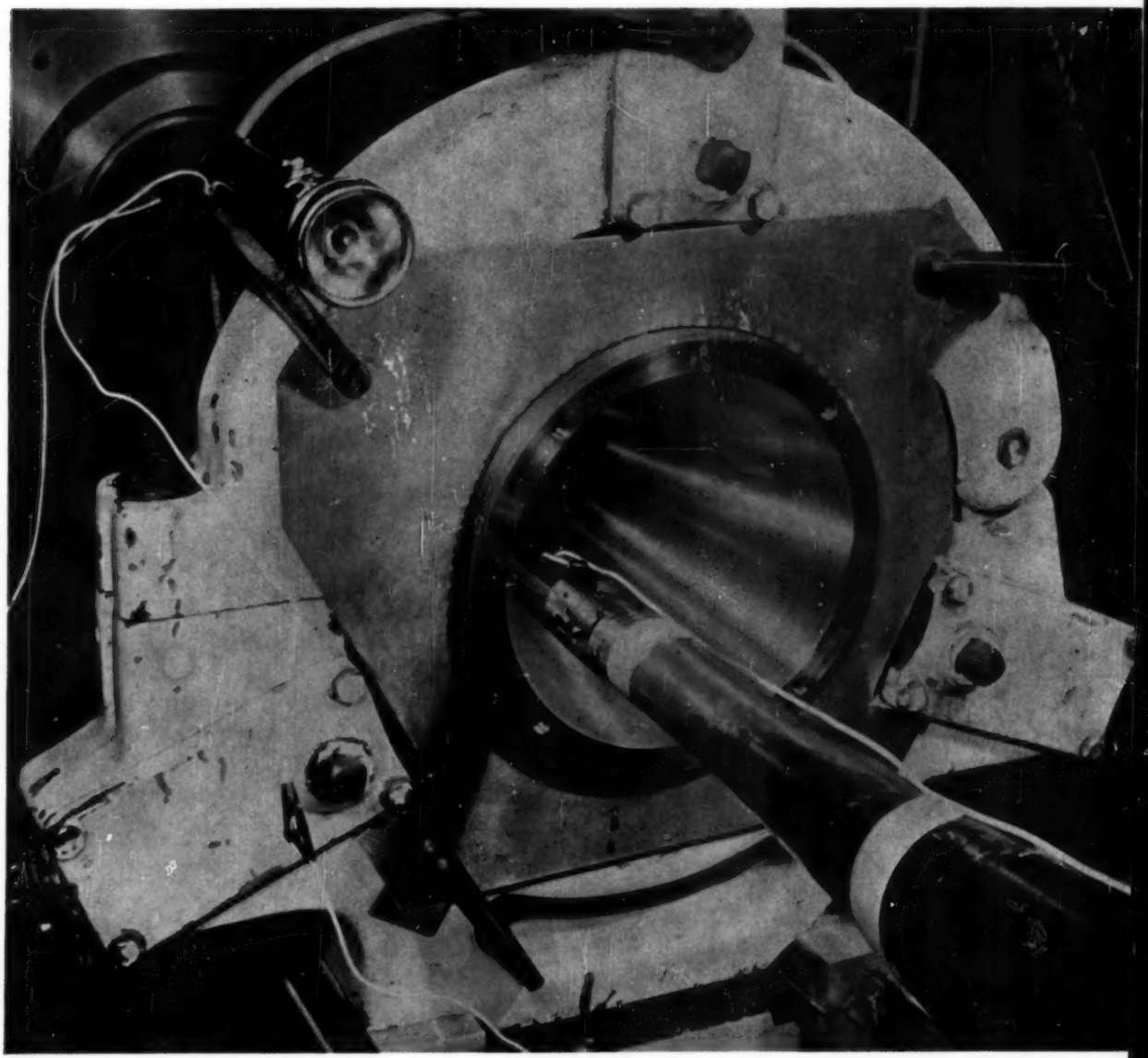
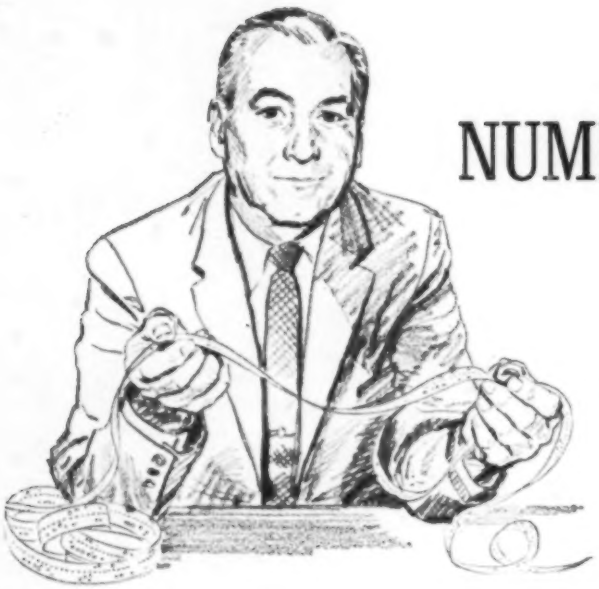


Contour machining a beryllium nozzle to "tenths"—see page 69

- **How to bore a "curved" hole,** page 66
- **1961: What kind of metalworking year?** page 77



NUMERICAL CONTROL...

A Realistic Appraisal

by A. Francis Townsend
Vice President, Engineering
The Heald Machine Company

At the 1960 Machine Tool Exposition, numerical control emerged as the shining new star on the metalworking horizon. In fact, if you didn't have something numerically controlled to demonstrate, you just weren't in the running.

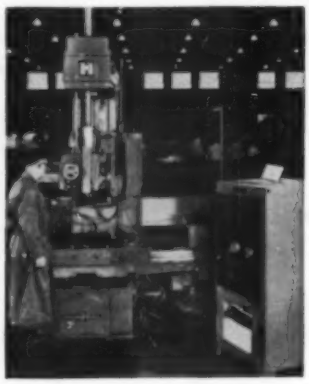
This subject is one that deserves a realistic appraisal. Is it a "fad" that will not stand the test of time? Or is it a panacea, a cure-all, that will eventually make all manually-operated machines obsolete?

Since Heald offers both numerically controlled and manually operated machines, we can afford to look at the subject objectively. Of this we can be sure—numerical control is here to *stay*. On the other hand, we can be equally sure that it is not the universal solution to all machining problems —and that manual operation will also be around for a long time to come.

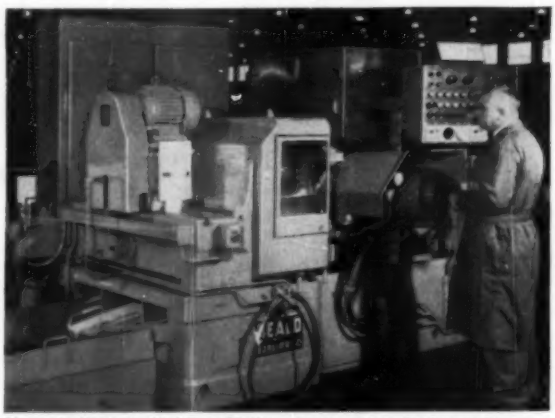
Where to use numerical control is largely a matter of production economics. How far it can be *profitably applied* depends on many factors, including the nature of the workpiece and the operations to be performed. In general, however, numerical control will usually be most advantageous where any of the following conditions are encountered.

1. Where several different setups are required on the same or different workpieces.
2. Where the operations performed are complex in nature.
3. Where manual setup time is relatively high.
4. Where time for tooling design, manufacture and use must be reduced.
5. Where variety and complexity of work require excessive tooling cost.

Properly applied, numerical control offers many profitable opportunities for making substantial cost reductions. Improperly applied, it will be a disappointing investment.



Numerically-controlled HEALDRILL makes high-precision layout or production drilling **fully automatic** —with tape control of precise hole location as well as selection of speeds, feed rates and tool change indication. A taped program for any workpiece can be stored and reused whenever needed for exact duplication of the most complex drilling operations.



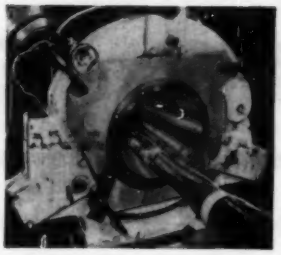
Numerically-controlled Bore-Matics permit contour boring and turning of irregular shapes with higher accuracy and precision than were heretofore obtainable. In routine production, the machine shown here contour turns an aluminum workpiece to ± .0001" of true path.

Your Heald engineer is fully qualified to help you evaluate the economics of numerical control for Borizing, grinding and precision drilling operations. It will pay you to call him in before taking the "plunge."

THE HEALD MACHINE COMPANY
Subsidiary of The Cincinnati Milling Machine Co.
Worcester 6, Massachusetts

CIRCLE 151 READER SERVICE CARD

COVER:
Boring a beryllium bar to make a Wind tunnel venturi on a Monarch lathe at Douglas Aircraft. See Page 69.



American Machinist / *Metalworking Manufacturing*

contents for January 9, 1961

VOLUME 105, NO. 1

Trends...

Metalworking Report.. 2
Spot News.. 45
Washington.. 47
Detroit.. 49
Aircraft and Missiles.. 51
Machine Tools.. 53
Materials.. 55
What's Ahead.. 57

Departments...

Publisher's Letter.. 38
Letters.. 40
Calendar.. 43
Editorial.. 61
Talking Shop.. 95
Practical Ideas.. 96
Names.. 99
New Materials.. 103
New Equipment.. 105
Field Report.. 113

Tooling up a stainless balloon . . . Step-by-step pictures of tooling procedures for welding thin-skin Atlas missiles. *By H M Edwards and W P McGregor, Convair Astronautics* 63

How to bore a "curved" hole . . . Two angular cuts are made by single pass-through tooling. *By Oliver R Wade, Tolerance Chart Services Co* 66

Cameron Iron extends closed-die forging . . . A 20,000-ton multi-ram press makes new sizes possible 68

Contour machining beryllium to "tenths" . . . Turning, gun drilling, and boring to close tolerances at Douglas-El Segundo 69

Safety's sacred cows . . . Many popular opinions about plant safety are illusions, says the author. *By John B Coyle, Michigan State University* 71

Heading with high-vanadium dies . . . Fastener manufacturers are finding savings in a 3½% vanadium die steel. *By Robert S Hodder, Latrobe Steel Co* 72

How a computer changes your company . . . Organization and policies may be drastically changed. *By Morrison H Watkins, Frank C Brown & Co* 74

SPECIAL REPORT NUMBER 501

1961: Output of metal goods to stay near record 77

Gross National Product 78
R & D Spending 78
New Plant & Equipment 79
Durable Goods 79
Industrial Products 80
Consumer Goods 80
New Orders for Machinery 81
Non-ferrous Metals 82
Steel 83
Exports 84
Machine Tool Orders 85
Wages and Prices 86
AM/MM Price Index 87
AM/MM Production Index 88

REFERENCE BOOK SHEETS

Screw machine work on aluminum, V, VI . . . Trouble chart for cutoff and tapping tools. *By M Bryan Baker, Kaiser Aluminum & Chemical* 91

TURN PAGE FOR METALWORKING REPORT——→

METALWORKING REPORT

. . . what's new and significant in manufacturing techniques and materials—

direct from our own staff and round-the-world news bureaus

MATERIALS . . . Biggest zinc die casting breakthrough in 30 years is claimed by The New Jersey Zinc Co in announcing its new ZAMAC-7. Using a base of **"the purest zinc ever applied commercially"** and the maximum practical reduction in magnesium content, plus a slight addition of nickel, the alloy is expected to revolutionize zinc die casting. With the same mechanical characteristics as ZAMAC-3 and ZAMAC-5, the alloy's casting properties permit **faster production rates,** fewer rejects, and **better surface finish.** Its cost: "Only slightly higher."

WELDING . . . Tig torches can cut, too. According to Linde Co, most of the Heliarc welding torches now in service will cut plate up to ½ in. thick if the **current is boosted** above normal welding range. Gas flow stays the same (40 to 60 cfh), and a standard dc welder with 70-v open-circuit capacity will do the job. The torch will cut **⅛-in. stainless at 20 to 40 ipm,** and the kerf is claimed to be good on one side. Linde's regular Constricted-Arc cutting torch will do better, but this isn't bad.

ASSEMBLY . . . Feeder for hand screwdrivers releases an operator's hand and speeds up hand assembly by **orienting tiny screws** so they can be picked up like dipping a pen in an inkwell. A vibratory bowl delivers the screws, head up, to a funnel into which the tip of a vacuum, magnetic, or spring-clip screwdriver is inserted. Burklyn Co, Los Angeles, developed the feeder for **hand and portable powered screwdrivers.**

INSPECTION . . . 7000-sq-ft clean room at Stewarts & Lloyds, Glascow, is for cleaning, dipping and assembling 32-ft pipe lengths for nuclear power-plant equipment. This is **one of the largest,** if not the largest, clean room to date, and has the usual gloss-paint walls, special floor coating, and filtered air under pressure. A typical job is assembling control-rod standpipes and sealing them before shipment.

FORMING . . . One steel for heading dies, for shallow-, medium-, and deep-hardening applications, is possible with Latrobe Hedervan, a carbon-vanadium steel. **Desirable case-core relationships** for all three kinds of applications are obtainable, and tool-life gains. for 3½-in. and smaller dies, have been as high as 3:1. For details, see p72.

CUTTING . . . Bent-hole boring can be done without cutting from two opposite ends of the part—a lucky convenience, because Tolerance Chart Services Co, Huntington, N Y, had an example with **two inside bends.** The solution is to operate the work in ganged rotary tables with a translating device that **locates the bend points exactly** as the tool cuts. For details, see p 66.

COMPONENTS . . . Constant-velocity universal joint developed by Bendix Corp is expected to reduce wear and stress on bearings, gears, and other transmission parts. It has **"rolling-end" motion,** eliminates splines. First application may be automotive.

FORMING . . . Dynapak mates with hydraulics at Convair to form 3-in. dia cups in 3/32-in. stainless steel. **Water acts as the punch,** forcing the sheet fully into a die cavity without thinning the material unevenly. It works upside down, with the sheet placed over the die, the sheet and die **inverted over water,** then the vertical Dynapak fired to drive the sheet and die down into the water. The incompressibility of water creates **equal back pressure** in all directions.

WELDING . . . Small 24-kw plasma gun weighs less than a pound and is under 2 in. long and only 1½ in. across (not counting handle). It has sprayed heat- and corrosion-resistant coatings **on inside walls** of small nozzles. Electrode life with argon-gas fuel is 200 hours; efficiency is over 60%. Plasmadyne Corp, Santa Ana, Calif, says it is the **smallest plasma unit** commercially available. In addition to this tiny model, the company has introduced an 80-kw gun which deposits 10 to 20 lb an hour.

CUTTING . . . Crowned abrasive belts for air-powered portable tools do better finishing and grinding, especially on inside contours, because they **will not cut with their edges.** The Behr-Manning belts are made 2 in. wide and 9, 15, or 19 in. in circumference to fit "Valcore" **inflated rubber drums,** produced by Nu-Matic Grinders, Inc. Air pressure delivered inside the drum controls exact crown shape, but grit size, rotary speed, and pressure on the work also have an effect. Grits available range 40 to 180.

FORMING . . . Biggest multiple-ram forging press to date is a 20,000-ton closed-die hydraulic machine built by Cameron Iron Wks, Houston, Texas. **First forging** is a 6000-lb funnel-shaped aircraft part of A-286 stainless 12½ ft long; extruding capacity is 30,000-lb work up to 30 ft long and 56 in. across. Unit is designed to forge **high-density alloy steels** for jet-engine and nuclear components. Maximum stroke is 90 in., and ram speed can be adjusted from zero to 400 fpm. Great versatility will be improved when side rams are added. For details, see p68.

MATERIALS HANDLING . . . Trolleys carry electroplate parts from any production department to the plating tanks and through the plating cycle **directly from a conveyor system** by Hanson-Van Winkle-Munning. Parts are racked, then carried by the trolleys on a plant-wide overhead monorail, and **automatically diverted to the plating area.** An indicator on each trolley is set to switch the trolley to any required area after plating. Parts are not handled manually except to be racked.

Continued on next page

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including 48th Annual Equipment Review

"Metalworking's biggest and most comprehensive source of buying information."

METALWORKING REPORT . . .

MANUFACTURING CONTROL . . . Productivity indexes are IBM's key to an accurate appraisal of operating results. Issued every quarter for all 15 company plants, the indexes measure changes in **physical output per worker** between a base year and the measured year. Unlike other systems, this one **excludes sales figures** and concentrates on pinpointing actual operating costs; productivity becomes strictly a shop problem. Full details will appear in a forthcoming issue.

MATERIALS . . . Sheet-rubber magnets are a British development (earlier products included rubber refrigerator gaskets) by Swift Levick & Sons, Sheffield. Sizes go **up to 40 in. wide,** made in a neoprene, PVC, and other elastomer base. One idea is for bicycle tires, with magnetic alternate poles around the OD, that would operate light generators (and perhaps also pick up nails and metal chips to an alarming degree).

CUTTING . . . High-speed Dumore heads are stock items now. Small-hole units (0.02 to ¼ in.) with spindle speeds from **800 to 15,500 rpm** will shortly be available with air feed, belt speed adjustment, and individual motors. Applications include jobs that call for carbides (where high speed allows lower chip load produced by lower feed per revolution), and for higher machined finish.

FINISHING . . . Vapor recovery saves degreasing solvent, and has cut solvent costs 50% in field tests by Vic Mfg Co, Minneapolis. The vapor is ducted to a tank where **activated carbon** extracts liquid solvent after steaming and decantering. Besides the salvage value, the system keeps the plant cleaner and stops vapor dumping in the surrounding atmosphere.

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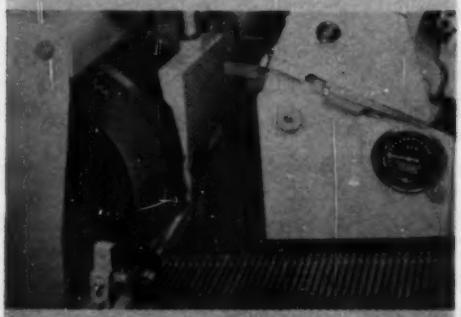
CENTERTYPE (Plain and Universal)



CENTERLESS

SUPER PRECISION

CHUCKING AND MICRO-CENTRIC

CINCINNATI

For lowest cost in any cylindrical grinding job choose a CINCINNATI

What's the best method of precision cylindrical grinding? There are many borderline applications which frequently make this a difficult question to answer. The right choice for any job is contingent upon extensive experience and impartial approach of the machine tool builder. That's why Cincinnati Grinding Specialists can spot the appropriate grinding application so quickly. These men are thoroughly familiar with and can select any of the following types of grinding machines, all built by Cincinnati:

Universal Grinding Machines, for the highest versatility in precision toolroom grinding.

Plain Grinding Machines. Built in 56 standard sizes to produce exceptionally fine finishes and close tolerances on any production basis. Including super precision grinding.

Angular Wheel Slide Grinding Machines, designed specifically to combine OD and shoulder grinding operations in a single, fast, automatic grinding cycle.

Roll Grinding Machines. For every size roll, from the finest Sendzimir to heavy duty rolls weighing 100 tons!

Centerless Grinding Machines. Nine sizes, for infeed and thrufeed operations, job shop as well as continuous production runs.

Chucking Grinding Machines. For production grinding, particularly that which is impractical by other methods.

Micro-Centric Grinding Machines, designed to grind the OD of antifriction bearing races and similar parts, producing accuracy within .000025" round and square.

Centerless Lapping Machines. Provide a low-cost production method of improving accuracy and finish of centerless ground work.

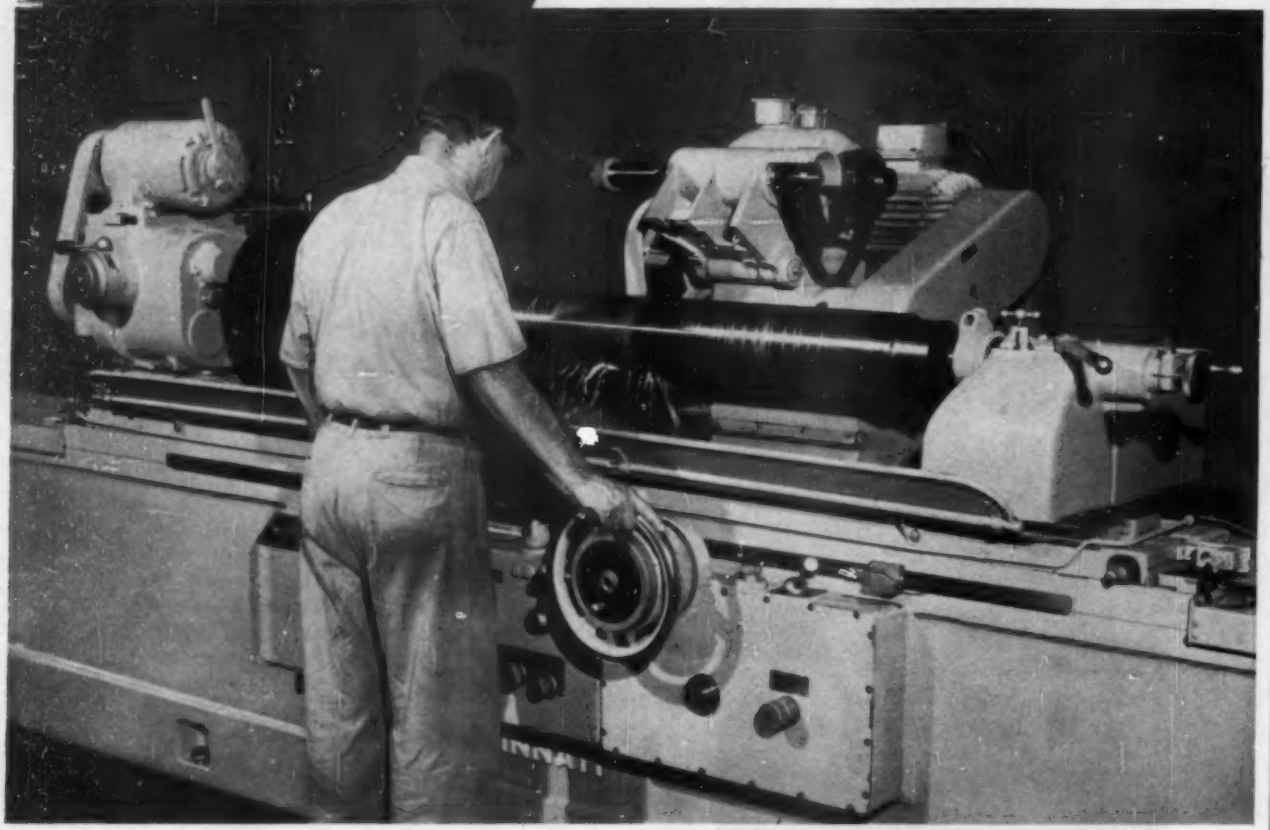
Only Cincinnati offers such a wide variety and range of grinding machines. You'll find further details on the two pages following. **Grinding Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

CINCINNATI®

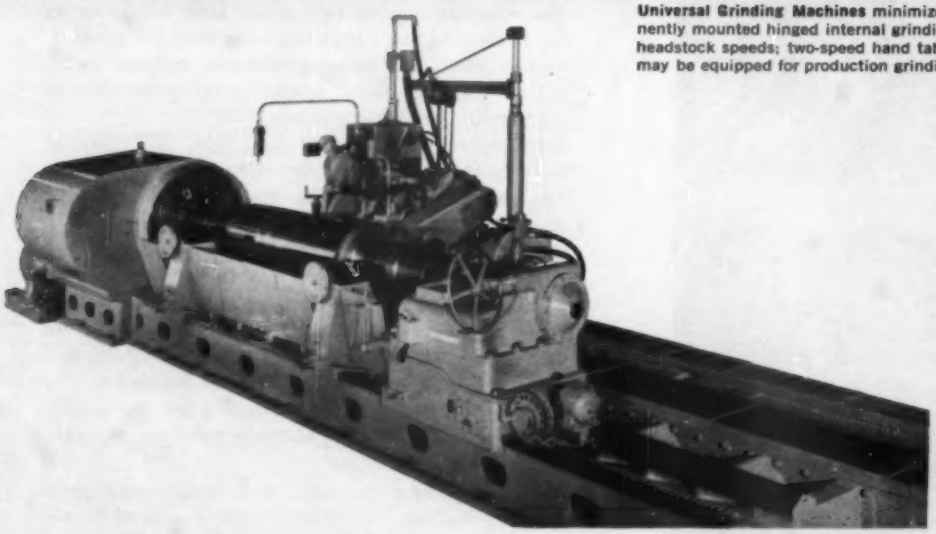
GRINDING MACHINE DIVISION

PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC • ROLL • CHUCKING • CENTERLESS LAPPING

CINCINNATI® GIVES YOU A SELECTION OF OVER



Universal Grinding Machines minimize setup time with permanently mounted hinged internal grinding head; infinite range of headstock speeds; two-speed hand table traverse. 10" machine may be equipped for production grinding.



Roll Grinding Machines are built in traveling table and traveling wheelhead types. The latter is illustrated. All have tilting wheelhead cambering unit.

CINCINNATI FILLMORE®

BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC

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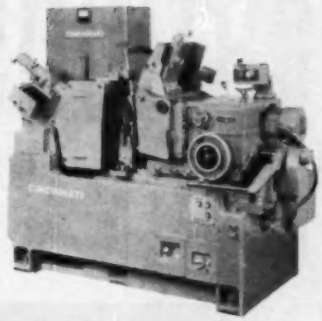
160 SIZES AND TYPES OF STANDARD GRINDING MACHINES

Cincinnati builds eight types of standard precision grinders—plain, universal, angular wheel slide, gap, roll, centerless, Micro-Centric, chucking. Cincinnati also builds special grinding machines and complete precision production lines. All are equipped with exclusive FILMATIC grinding wheel spindle bearings of lifetime, no-maintenance construction. Complete specifications furnished on request. Telephone or write **Grinding Machine Division, The Cincinnati Milling Machine Co.**, *REdwood 1-2121.*



Centerless Grinding Machines. Cincinnati is the only manufacturer of a complete line of nine machines. No. 220-8 Centuramic (illustrated) has wide range of application; small lot or job shop production. Nos. 5 and 6 sizes are tooled up for specific jobs.

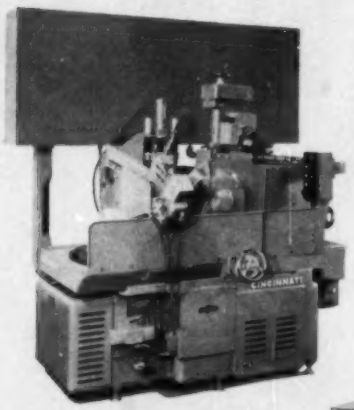
machine	length between centers	spindle drive
Universals		
10"	24"	2 hp
12"	36", 48", 72"	3 hp
14"	36", 48", 72"	5 hp
18"	36", 48", 72"	5 hp
Plain		
4"	18"	3 hp
6"R and 10"L	18", 30"	7½ hp
10"R and 14"L	18", 36", 48", 72", 96"	15 hp
14" and 16"	36", 48", 72", 96", 120", 144", 168"	20 hp
18" and 24"	48", 72", 96", 120", 144", 168", 192", 216", 240"	25 hp
24" H.D. and 28" H.D.	96", 120", 144", 168", 192"	30 hp

machine	work diam.	drive
Centerless		
107-4	0" - 1½"	7½ hp
220-8	0" - 4¼"	20 hp
325-12	⅛" - 6"	25 hp
330-15	⅛" - 6"	30 hp
340-20	⅛" - 6"	40 hp
430-12	⅛" - 10"	30 hp
440-20	⅛" - 10"	40 hp
No. 5	1" - 7"	75 hp max.
No. 6	1" - 10"	75 hp max.

machine	length between centers	spindle drive
Angular Wheel Slide (30° or 45°)		
6"R and 10"L	18", 30"	7½ hp
10"R and 14"L	18", 36", 48", 72"	15 hp
Gap		
16" (40" swing in gap)	96", 120", 144", 168"	20 hp
Roll		
18" and 24" (Traveling Table)	48", 72", 96", 120", 144", 168", 192", 216", 240"	25 hp
24" H.D. and 28" H.D. (Trav. Table)	96", 120" 144", 168", 192"	30 hp
36" (Traveling Wheelhead)	120", 144", 168", 192", 216", 240"	30/40 hp
44", 50" and 60" (Traveling Wheelhead)	144", 168", 192", 216", 240", 264", 288"	30/40 hp

machine	work diam.	drive
Chucking		
No. 1	0" - 4"	5 hp
No. 2	2" - 10"	7½ hp
Micro-Centric		
No. 1	⅛" - 4"	5 hp
No. 2	2" - 10"	7½ hp
Centerless Lapping	¼" - 6"	7½ hp

Note: H.D. = Heavy Duty



Micro-Centric Grinding Machines operate on a unique principle which generates accuracies within .000025" round and square with one end on comparatively short parts. May be tooled up for completely automatic production.

Plain Grinding Machines. Automatic grinding wheel balancing is standard equipment for 6"R to 16" machines. ACRASIZE Gaging, Gage Line Attachment, Dual Rate Automatic Infeed and other cost-reducing equipment available for 4" to 14"L sizes. Larger machines are industry's choice for heavy duty work.

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GRINDING MACHINE DIVISION

now you can check & record fine-pitch gear accuracy

Actual Size

at 1600 magnifications

on the No. 4 Fellows Red Liner

Now, the No. 4 Red Liner makes "composite" checks on the finest instrument gears with unbelievable accuracy and sensitivity. 1600 to 1 magnifications are obtained with the electrical recording system which gives a written, unbiased record for instant reading or for proof-of-accuracy files.

One report states – "11 teeth, 200 D. P. pinion backed up to a 100 tooth gear on a cluster, checked easily on the No. 4 Red Liner."

The job shown is 96 pitch with 22 teeth on the small gear and 80 teeth on the larger gear. The pinion shaft rides in vees in a turret-type fixture.

Fellows inspection units cover a range from the tiniest instrument gear up to some that are 24 inches in diameter.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Investigate the full line of [illegible] *inspection equipment*

No. 4 Fine-Pitch Red Liner

No. 8M Red Liner

No. 20M Red Liner

No. 12H Lead Measuring

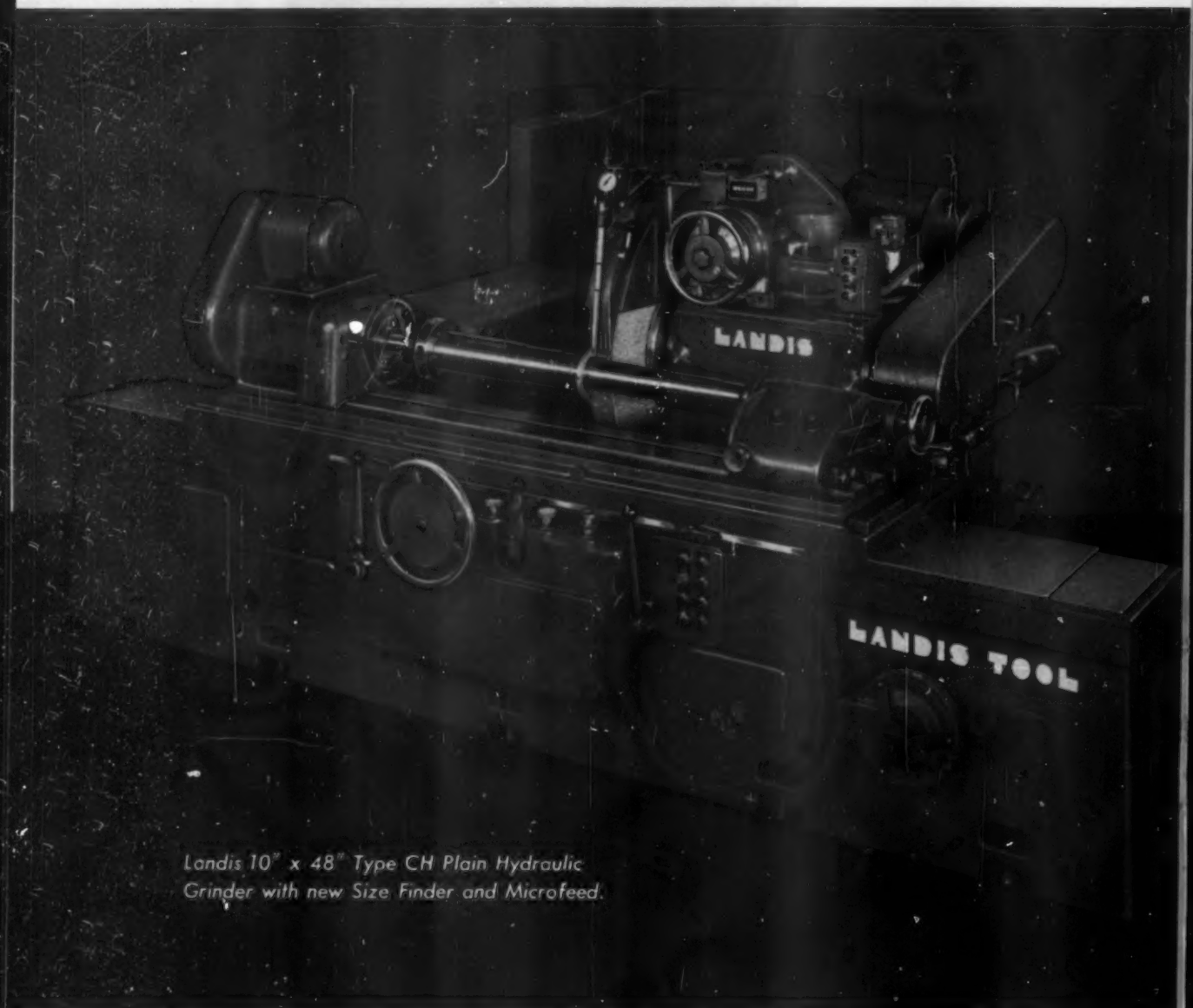
No. 12M Involute Measuring

THE PRECISION LINE

Fellows *Gear Production Equipment*

Landis grinder with new Size Finder

new Landis development with Microfeed lowers grinding costs on lathe headstock spindle... saves setup time... assures close tolerances



Landis 10" x 48" Type CH Plain Hydraulic Grinder with new Size Finder and Microfeed.

LANDIS TOOL COMPANY

saves 82 minutes grinding 9 diameters

production data

Part:.....Lathe headstock spindle

Machine:.....Landis 10" x 48" Plain Grinder with Size Finder and Microfeed

Operation:.....Grinding 9 different diameters. One diameter is tapered

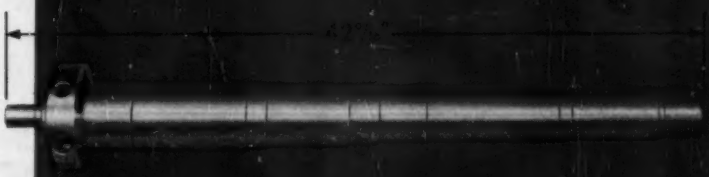
Production:.....With new Landis Size Finder—1 part every 42 minutes

Former method—1 part completed in 124 minutes

Stock removal:..020"-.030"

Part tolerances: Size—.0005" max. Roundness—.00005" max. Straightness—.0001"

Finish:.....25 RMS



How size finder speeds multiple diameter shaft grinding

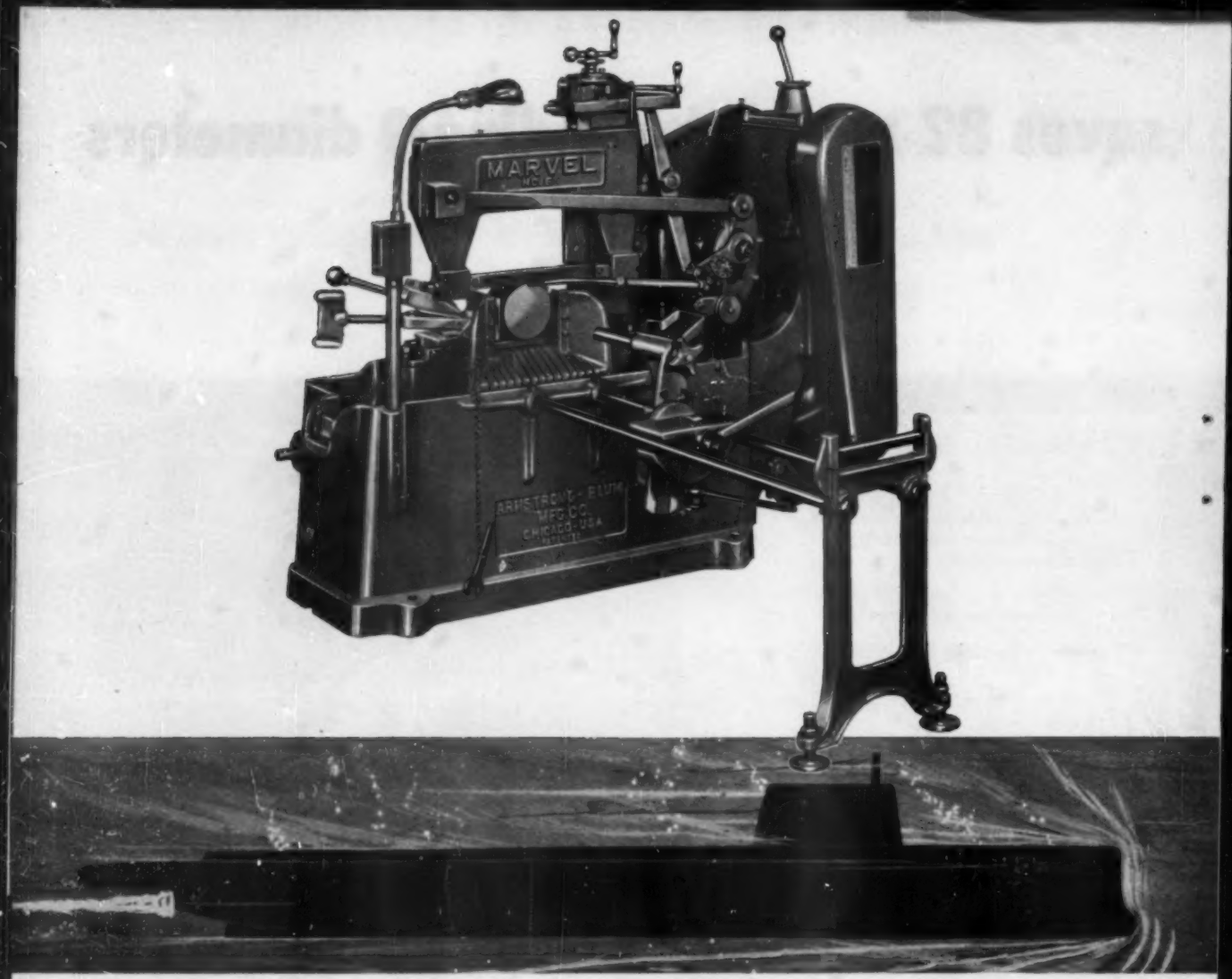
The new Landis Size Finder is a direct reading indicator on the wheel feed handwheel. It permits the operator to set the finish dimension on the indicator by turning the wheel feed handwheel. This establishes the face of the wheel to the correct position to grind the desired dimension. Operator starts the cycle, applies the sizing gage and stops the cycle when the gage shows finish size. He moves the work table, resets the Size Finder for the next diameter and repeats the cycle.

Size Finder with Microfeed shows remarkable savings in setup and grinding time. Send us prints of your shaft for our proposal.

WAYNESBORO, PENNSYLVANIA

LANDIS

precision grinders



OBSOLETE ?

Emphatically no—not when a Marvel Hack Saw like this one can cut 4600 blanks of 3¼" round 303 stainless steel for just 1½ cents blade cost per cut—not when these 4600 blanks were cut-off at the rate of 20 pieces per hour, floor to floor! And this is typical production performance at that.

Obsolete? This Marvel Hack Saw Machine is as modern in performance as the next atomic powered submarine that will slide down the ways!

If you want faster cutting, the Marvel Hack Saw has speed to spare; accuracy of cut is assured by the rugged construction of the machine itself; blade cost. in many cases is less than 1¢ per cut.

When you consider these advantages and their low initial cost, Marvel No. 6 and No. 9 Series High Speed Heavy Duty Ball Bearing Hack Saws, as we build them, are your best cutting-off equipment buy today.

We can prove our point by demonstrating Marvel Sawing efficiency on your own work, without any obligation on your part. Because we have consistently built both Hack Saws and Band Saws for more than 40 years, we will give you an unbiased recommendation.

Catalog C-60 illustrates and describes the complete line of Marvel Sawing Machines. Write for your copy.

MARVEL *Metal Cutting* **SAWS**

BETTER MACHINES
BETTER BLADES

ARMSTRONG-BLUM MANUFACTURING CO. · 5700 Bloomingdale Avenue · Chicago 39, Illinois

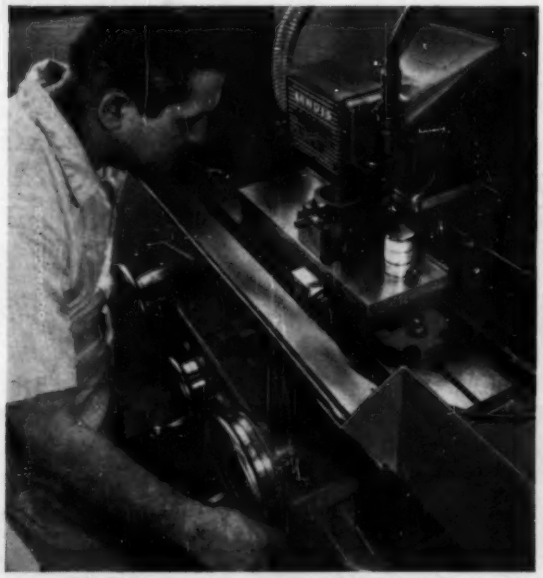
S-1317

CIRCLE 161 READER SERVICE CARD

Landis Abrasive No. 618 surface grinders at Speedring Corporation, Warren, Michigan

Speedring reports surface grinding missile components to 15 millionths using electronic gauging

Finish grinding missile components on a Landis Abrasive No. 618 shown with electronic gauge and master block for checking height.

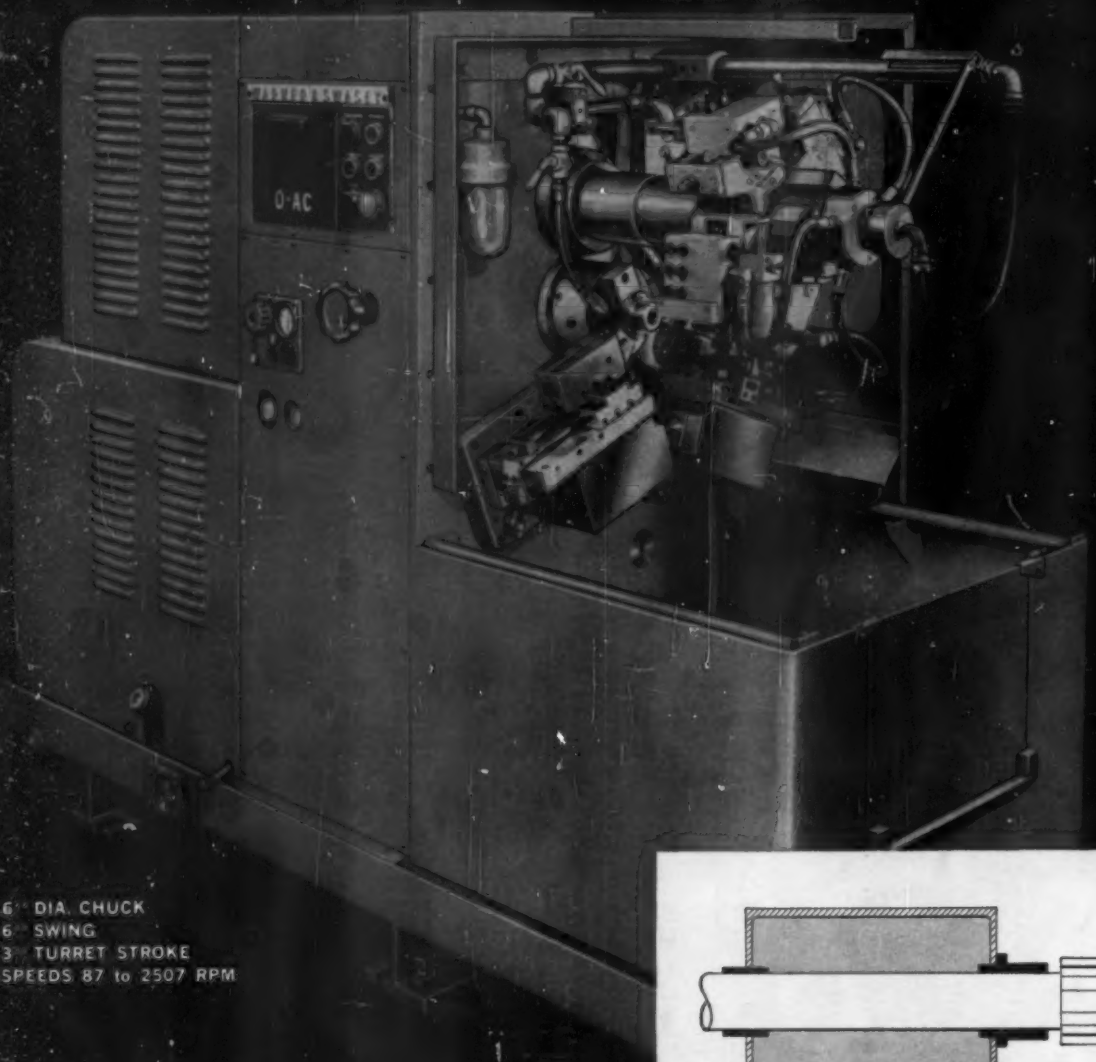


Landis Abrasive No. 618 surface grinders are top choice at Speedring for grinding missile components and gyro parts. They report that the table and spindle accuracies required to grind pure beryllium, beryllium oxides, ceramics, ferrites and many other exotic metals in their plant are rigidly controlled on these Landis Abrasive surface grinders.

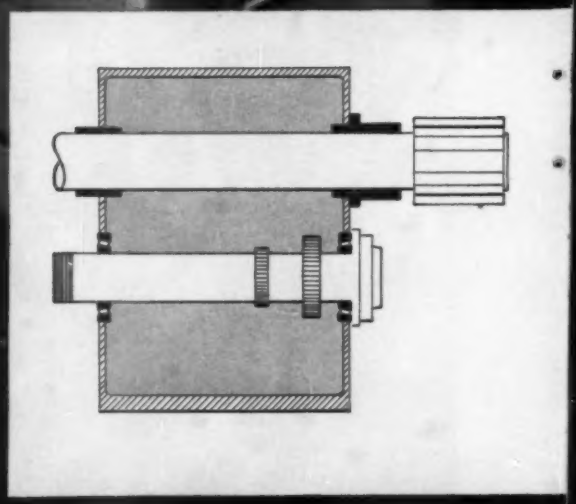
LANDIS
ABRASIVE
precision surface grinders

Landis Tool Company, Waynesboro, Penna.

NOW YOU CAN AUTOMATE PRODUCTION



6" DIA. CHUCK
6" SWING
3" TURRET STROKE
SPEEDS 87 to 2507 RPM



Spindle rise has been practically eliminated in the O-AC by placing the spindle and turret bearings in the same housing where they are subjected to exactly the same temperature, and continually lubricated with clean, filtered oil.

OF SMALL PRECISION PARTS with the New Warner & Swasey O-AC Single Spindle Chucking Automatic

Warner & Swasey's newest addition to its proven line of Single Spindle Chucking Automatics — the O-AC — is specifically designed to automate the production of small precision parts in all lot sizes — even as few as 30 or 40 pieces.

SMALL LOTS are profitable on the O-AC because it sets up fast and can be changed from job to job quickly and easily. There are no cams to design, change or store. The tooling area is uncluttered, easy to get to for faster cutter setting and adjustments.

PRECISION work piece tolerances and fine finishes on a repetitive piece-after-piece automatic basis are routine for this new single spindle chucker. Because of its unique overhead turret construction, only the O-AC can assure this high degree of production accuracy.

VERSATILE PERFORMANCE results from the O-AC's unique tool slide actions. A wide range of work — from ordinary small castings to complicated missile components — is efficiently handled, usually with low-cost standard tooling.

Your Warner & Swasey Field Engineer has the complete facts on the new O-AC ready for you. Or write us direct, Warner & Swasey Co., Cleveland 3, Ohio.

All automatic functions are rapidly set up by the simple placement of trip blocks and switch operating screws. All automatic functions can be individually hand controlled during setup and switched to "automatic" or back to "hand" at any time with a single control switch.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

ARMSTRONG

SET-UP *and* HOLD-DOWN TOOLS

ARMSTRONG PLANER JACK — ARMSTRONG BRACING JACK — ARMSTRONG VERTICAL JACK — ARMSTRONG ADJUSTABLE STEP BLOCK

ARMSTRONG "T" SLOT BOLT — ARMSTRONG "T" SLOT NUTS

ARMSTRONG NUTS — ARMSTRONG WASHERS

ARMSTRONG UNIVERSAL ADJUSTABLE CLAMP

ARMSTRONG SET-UP WEDGES — ARMSTRONG "T" SLOT CLAMP

ARMSTRONG PLAIN CLAMP — ARMSTRONG SCREW HEEL CLAMP — ARMSTRONG GOOSE NECK CLAMP

ARMSTRONG DOUBLE FINGER CLAMP — ARMSTRONG FINGER CLAMP — ARMSTRONG "U" CLAMP

Whatever its shape, a work piece can be quickly, easily and safely set up on any T-slotted table with ARMSTRONG Set-up Tools. Comprising a complete "system" of supporting and holding devices in all essential sizes, ARMSTRONG Set-up Tools usually pay for themselves on the first job and continue to lower costs for years to come.

Save Time: Keep costly machines and high priced men producing—save time otherwise lost while operators rummage in the scrap box for materials with which to devise makeshift set-up methods.

Prevent Breakage and Spoilage—correctly designed, machined from special steels or drop forged and heat treated, they are extremely stiff, strong and reliable.

Increase Accuracy—hold work rigidly and support it fully regardless of shape.

Prevent Accidents—end risk of set-up failure with resulting tool breakage, damage or personal injury.

Increase Profits—by reducing down time, increasing man hour output, assuring accuracy, ARMSTRONG Set-up and Hold-down Tools cut costs and build profits. They are part of every properly equipped tool room and shop.

Your Local Armstrong Industrial Distributor carries a good stock of Set-up and Hold-down Tools. He offers you quick, efficient service on these, as well as other, quality ARMSTRONG Tools.

ARMSTRONG BROS. TOOL CO.
5215 W. ARMSTRONG AVE. • CHICAGO 46, ILL.

TAREX

A Single Spindle Automatic...

With a Turret Lathe Swiss Precision

Only single spindle turret lathe with—

Universal spindle for both chuck and bar work without ever changing spindle*

Direct drive by gears—no chains

Set-up time reduced up to 60%

Tremendous versatility—exclusive, ingenuously designed standard and extra-capacity attachments.

*Only automatic that can machine hot rolled as well as cold drawn bars without changing spindle.

TAREX can solve all your chuck and bar work from dia. ¾" to 3½" of bar and 8" of chuck work.

Engineered for U.S. Production; Built and Serviced with Swiss Precision.

Submit your machining problem with blueprints for analysis and our recommendations.

Exclusive U. S. Representatives

THE ARTHUR LOEFFEL COMPANY, INC.

MERRICK, N.Y. • TEL. FREEPORT 9-8600 Offices in Chicago and Los Angeles

CIRCLE 166 READER SERVICE CARD

NEW *from* NORTON

Segments of new 23 ALUNDUM abrasive . . .*

premium performance at non-premium price

Surface grinding gets a real performance-lift from Norton — combined with a definite economy!

Newest development for segments for vertical spindle surface grinders is 23 ALUNDUM abrasive.

This is no ordinary aluminum oxide. Here you get premium toughness and sharpness — plus the friable nature that eliminates dressing.

Two other big advantages are versatility and uniformity. 23 ALUNDUM abrasive is ideal for surface grinding carbon steels, mild steels, stainless steels, Meehanite and aluminum. And to this broad range 23 ALUNDUM segments bring maximum uniformity of performance — the results of a two-year Norton project to develop the closest possible duplication of structure and dimensions.

Users already know these benefits

Segments of 23 ALUNDUM abrasive have had thorough test runs from coast to coast. The following reports from Norton surface grinding customers are typical:

- *"With the new segments we get freer cutting and higher production rate."*
- *"Very good on all our metals. Required no dressing."*
- *"No burn, even with full power. Better finish, longer life on all metals. We're standardizing on '23'."*
- *"Best segments we've ever used for general purposes, including chrome plate."*
- *"Much less dressing, faster cut, less heat."*

Find out how 23 ALUNDUM segments can benefit your own production. See your Norton Distributor about a test run in your plant. Or your Norton Man will give you plenty of facts about this big, new advancement in surface grinding. NORTON COMPANY, General offices, Worcester 6, Massachusetts. Plants and distributors around the world.

W-2001

NORTON
ABRASIVES

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

Making better products . . . to make your products better

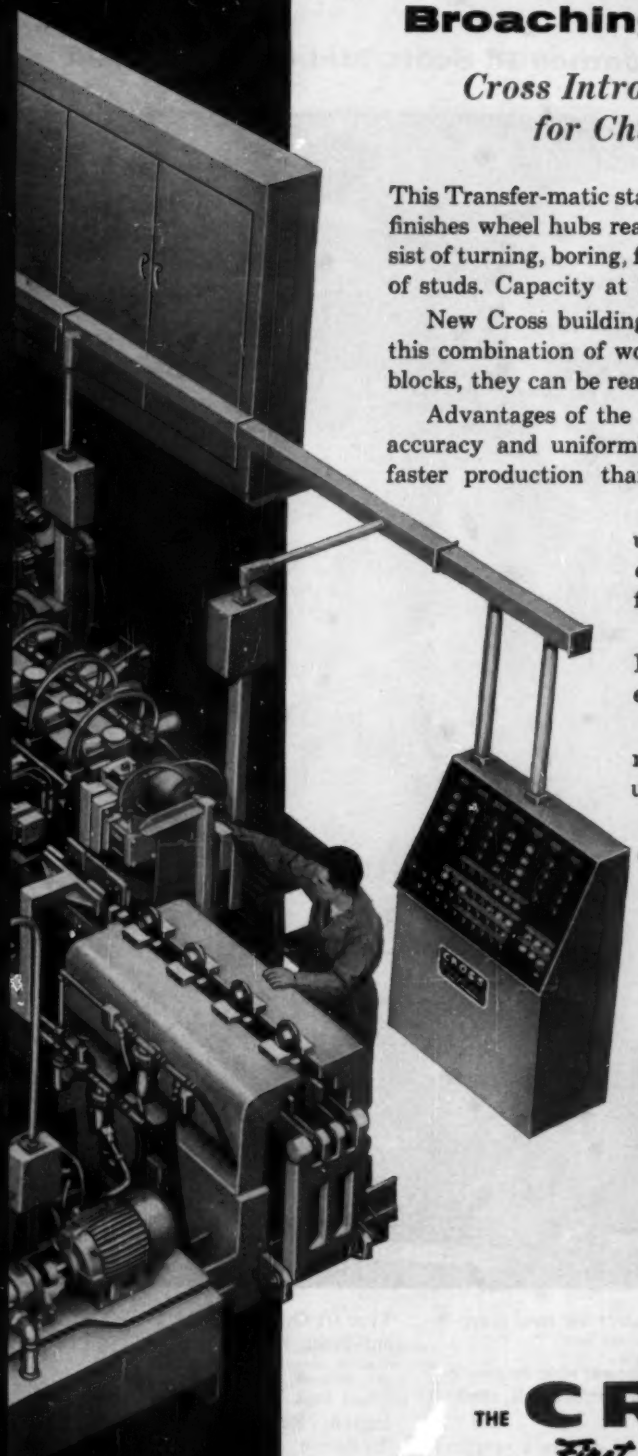
NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Tool slides are rotated to the upward position so tools can be seen, reached and replaced easily.

Another Automation First by Cross

New Transfer-matic Combines Chucking with Drilling, Broaching and Assembly

Cross Introduces Building Blocks for Chucking Operations



This Transfer-matic starts with rough castings and completely finishes wheel hubs ready for final assembly. Operations consist of turning, boring, facing, drilling, broaching, and assembly of studs. Capacity at 100% efficiency is 200 parts per hour.

New Cross building blocks for chucking operations make this combination of work possible. Like other Cross building blocks, they can be rearranged as requirements change.

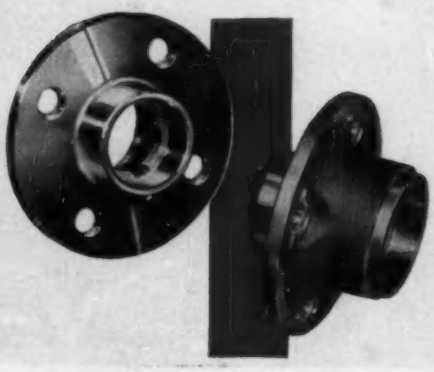
Advantages of the new Transfer-matic include maximum accuracy and uniformity, higher output, less handling, and faster production than conventional methods.

Heavy duty, three jaw chucks are used on the roughing operations but diaphragm types are employed for finishing to avoid clamping distortion.

A work bank between Sections I and II permits independent operation of either one during maintenance.

The new building blocks include a novel slide unit which tilts the tools upward to speed changes.

Cross engineers will gladly discuss details of this Transfer-matic with you.



Established 1898

THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

CIRCLE 170 READER SERVICE CARD

A "live" demonstration from Brown & Sharpe...

"Let me show you how Brown & prevents mixups in steel

...Mr. James R. Scott, Metallurgist, Heat

"Brown & Sharpe puts this smooth blue finish on its Ready Mark® flat stock to solve three problems tool and die makers and heat treaters have had for years...

FIRST: *To prevent mistakes in the type of steel* picked up for a job. The blue color gives permanent identification, no matter how small the piece.

SECOND: *To protect the steel indefinitely from rust.*

THIRD: *To save layout time by giving you a pre-colored surface,* all ready for scribing.

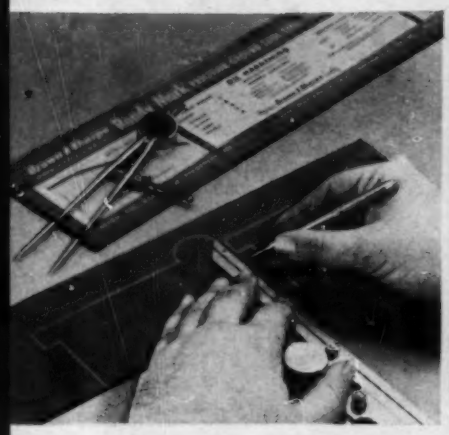
"Saves thousands of dollars a year in cracked dies and other spoiled work that a mixup in steel and hardening can cause! You can't mistake this A.I.S.I. Type 01 Oil Hardening Tool Steel for any other. It's always *blue.*

"And look at the automatic rust protection. Ready Mark's .0002"-thick 'Endurion' finish has better corrosion resistance for its thickness than any other known commercial finish. It can lie around for years, in good condition.

CIRCLE 171 READER SERVICE CARD

Sharpe's Ready Mark Flat Stock and saves layout time!"

Treating Dept., Brown & Sharpe Mfg. Co.



"Better yet — it saves you layout time. There's no grease to take off — no marking fluid to put on — no drying to wait for. Ready Mark Blue is all ready for layout when you get it. You just start scribing!

"Notice the color won't rub off or flake off the way marking fluids will. It won't even wash off in water, oils, coolants, or other agents used in shops. Your layout lines stay sharp and clear, through tough handling and machining.

"Color burns off during heat treatment, without affecting the treatment—leaves the piece at finish tolerances. This color deposit doesn't penetrate the steel or tend to etch the surface — so it doesn't have to be ground off later.

"Under the color, you get the country's best free-machining, non-deforming A.I.S.I. Type 01 Oil Hardening Tool Steel. Every lot is quality tested to be sure that it meets rigid Brown & Sharpe specifications.

"We grind it to precise sizes for you — every one free from decarb and machining stresses. They're colored . . . individually packaged . . . with complete description and heat treating instructions on each package.

"You don't have to settle for anything less than Ready Mark. It doesn't cost a cent extra! And by switching to Ready Mark, you make steel handling easier for everybody from the tool crib to the heat treating department."

Get it, fast, from your Brown & Sharpe distributor. Brown & Sharpe Mfg. Co., Providence 1, R. I.

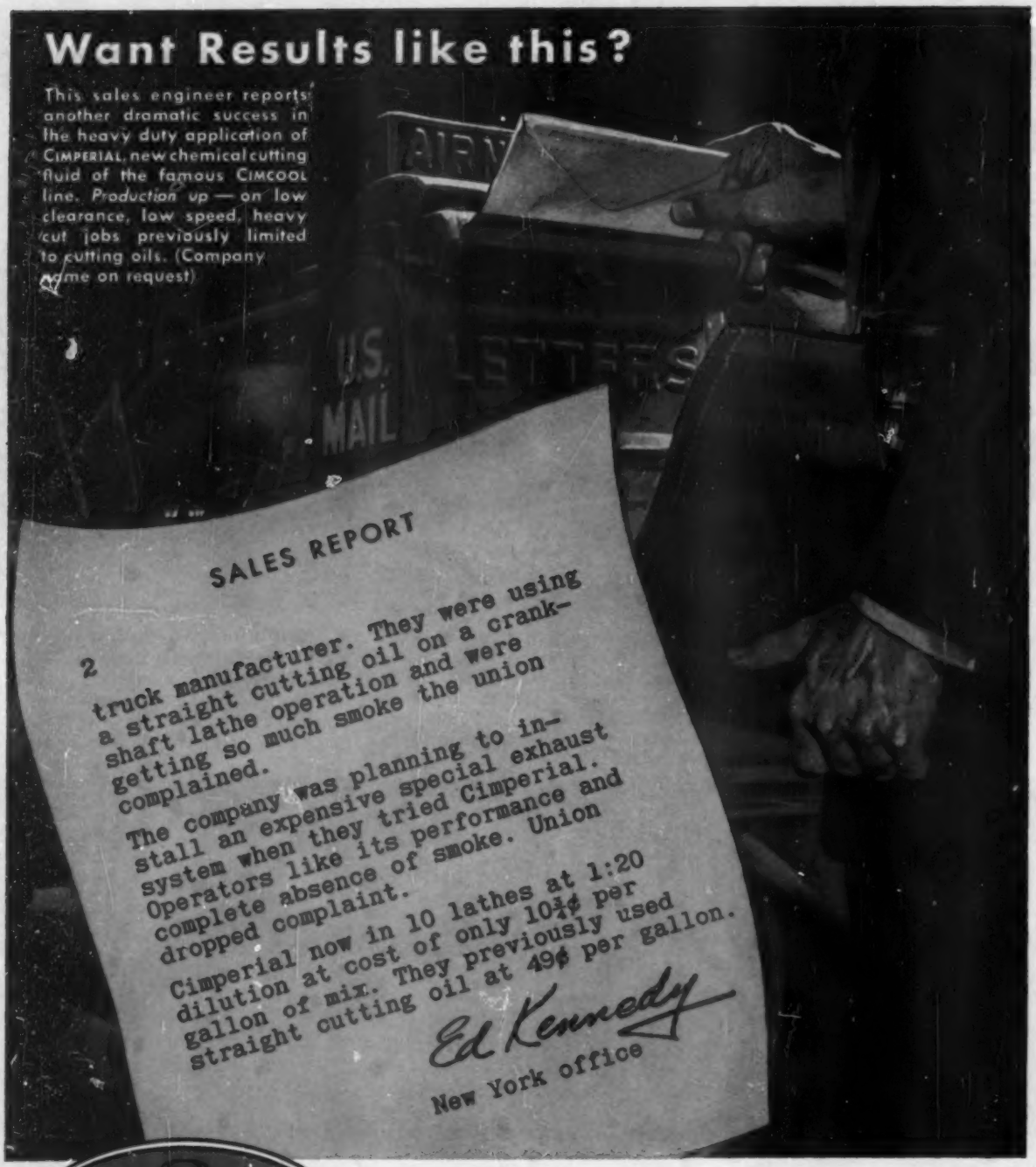
Also available from Brown & Sharpe: Bright finished flat stock in same analysis and sizes as above • Ready Mark **Air-Hardening Die Steel,** colored **maroon.** (A.I.S.I. Type A2—has exceptional dimensional stability) • **Bright finished low-carbon "Thrift" Stock** • **Special sizes** in all types at reasonable cost.

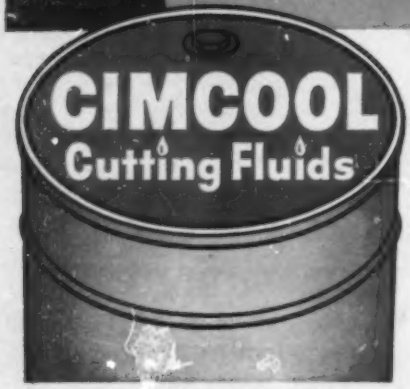
Brown & Sharpe PRECISION CENTER

CIRCLE 172 READER SERVICE CARD

Want Results like this?

This sales engineer reports another dramatic success in the heavy duty application of CIMPERIAL, new chemical cutting fluid of the famous CIMCOOL line. *Production up* — on low clearance, low speed, heavy cut jobs previously limited to cutting oils. (Company name on request)


SALES REPORT
2
truck manufacturer. They were using a straight cutting oil on a crank-shaft lathe operation and were getting so much smoke the union complained.
The company was planning to install an expensive special exhaust system when they tried Cimperial. Operators like its performance and complete absence of smoke. Union dropped complaint.
Cimperial now in 10 lathes at 1:20 dilution at cost of only 10¼¢ per gallon of mix. They previously used straight cutting oil at 49¢ per gallon.
Ed Kennedy
New York office



FOR 100% OF ALL METAL CUTTING JOBS

Production-proved products of The Cincinnati Milling Machine Co.

CIMCOOL 52 Concentrate — The pink fluid which covers 85% of all metal cutting jobs.
CIMPERIAL® — Newest in the famous, industry-proven line of CIMCOOL® Cutting Fluids.
CIMPLUS — The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, 55) — For every job requiring an oil-base cutting fluid.
ALSO — CIMCOOL Tapping Compound — CIMCOOL Bactericide — CIMCOOL Machine Cleaner.

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor. Or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

®Trade Marks Reg. U. S. Pat. Off.

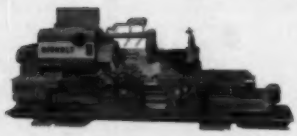
Production Pointers

from GISHOLT

More cost-cutting IDEAS— to help you

ANCHOR EQUIPMENT REDUCES TIME, TOOLING AND HANDLING

Indexing fixture, cross-feeding turret boost productivity 60%



The problems solved with this setup may be similar to those you face. Anchor Equipment Company, San Francisco, Calif., wanted to reduce tool costs, multiple setups, in-process inventory, and machining time on steel gate valve bodies. Here's how they did it, and improved accuracy as well:

They obtained a Gisholt MASTERLINE® 3L Saddle Type Turret Lathe, with a 42″-swing gapped bed, a 5-position indexing fixture, and a cross-feeding hexagon turret.

The 5-position indexing fixture permits completing all three ends of the 6″, 150-lb. steel gate valve body, shown, in just one chucking (includes two 5° seat areas). A swinging push-button control permits the operator to observe the operation with minimum movement. Fixture jaws change fast to accommodate a variety of work sizes.

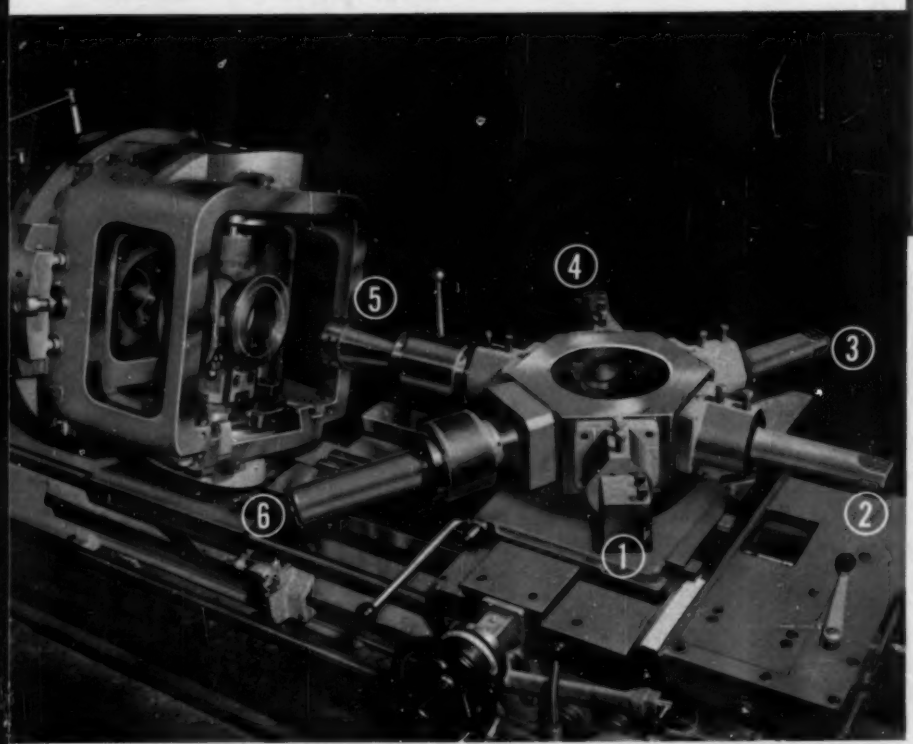
The cross-feeding turret permits use of standard, low-cost boring bars and toolholders. It also permits handling both on- and off-center work (facing, turning, grooving, boring, etc.), eliminating need for a cross slide.

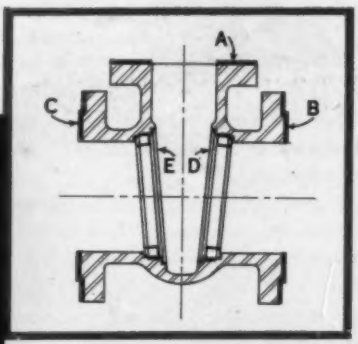
The caption tells how f.t.f. time was reduced 40% on a typical job.

3L cuts time 40%. Cross-feeding hex turret provides versatility, cuts tool costs. Fixture permits completing three ends, two angular seat ring surfaces, and driving of seat rings—all in one chucking.

For information on 3L, circle No. 743 on inquiry card.

Gisholt MASTERLINE 3L tooled for 6″, 150-lb. cast steel gate valve cuts time 40%. Basic setup handles valves 4″, 150-lb., to 10″, 300-lb. Hex 1 tools can serrate raised face of run flanges, and hex 3 tools can finish-face seat rings in place, if required.





Machining sequence on 6″ steel gate valve body: Hex 1—face A, index fixture 90°, face B, index 180°, face C. Offset fixture, index to 5° seat position, rough- and finish-bore and face D from hex 2 and 3. Form relief and chamfer—hex 4. Index to opposite 5° seat position; use reverse feed (standard on Gisholt Saddles); repeat operations on E from hex 2, 3 and 4. Use reverse lead and reverse spindle, thread E from hex 5. Index to opposite 5° position; thread D with forward lead and spindle, and second set of chasers on same bar—hex 5. Drive seat ring—hex 6 (adjustable torque release on driver simplifies operation). Index again, reverse spindle, drive opposite seat ring. One machine boosts total production 60% over previous method using three older machines.

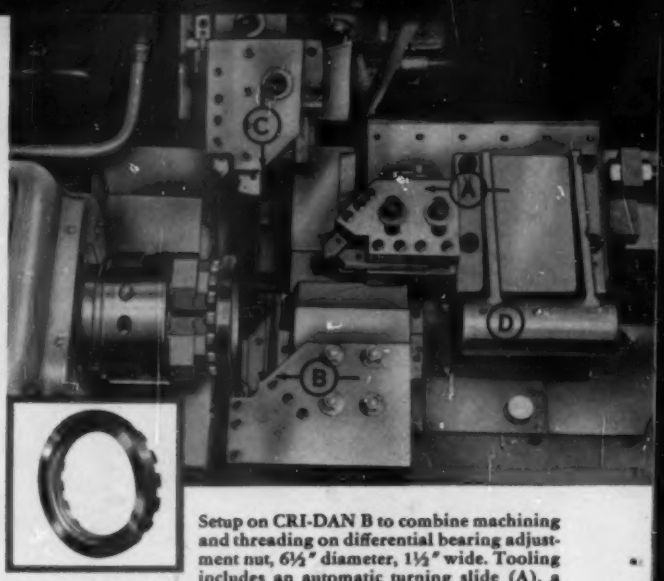
HOW MACK TRUCKS, INC., SAVES TIME BY COMBINING OPERATIONS

Small CRI-DAN B threads work beyond normal range of die heads

If you're looking for ways to head off rising costs, study this setup used by Mack Trucks, Inc., Plainfield, N. J. It shows how you can combine standard machining with single-point threading on the Gisholt CRI-DAN Threading Lathe. In this case, machining and threading times were slashed an average of 60%...work-handling time and floor space were cut in half...and, with all operations completed in one chucking, quality has improved substantially.

The setup, shown at right, handles a variety of over ten cast iron adjustment nuts. Previously, two machines were required: one to machine, the other to mill the thread. To see how CRI-DAN lets others do it for less, study the one-cycle, combination job sequence at right.

Cost-alert management is vitally interested in equipment that can perform like this. Contact your Gisholt Representative or circle No. 744 on inquiry card for complete details.



Setup on CRI-DAN B to combine machining and threading on differential bearing adjustment nut, 6½" diameter, 1½" wide. Tooling includes an automatic turning slide (A), a standard front threading slide (B), an automatic facing slide (C). The part is located against driving lugs and is chucked in rough bore.

Automatic cycle: Slide (A) tools turn and chamfer O.D.; single-point threading tool on slide (B) produces 12 t.p.i., .054"-deep thread on O.D. in 18 passes, with .003" tool in-feed per pass. A second "feathering" tool on slide (B) removes a portion of first revolution of thread to eliminate possibility of turning over or breaking off; slide (C) tools face front and chamfer rear O.D. edge. Time: only 106 seconds, f.t.f. A revolving center can be mounted in bracket (D) for parts requiring additional support.

INGERSOLL-RAND BOOSTS PRODUCTIVITY ON LINERS

No. 24 Automatic Lathe machines 20 surfaces with tandem tool slides

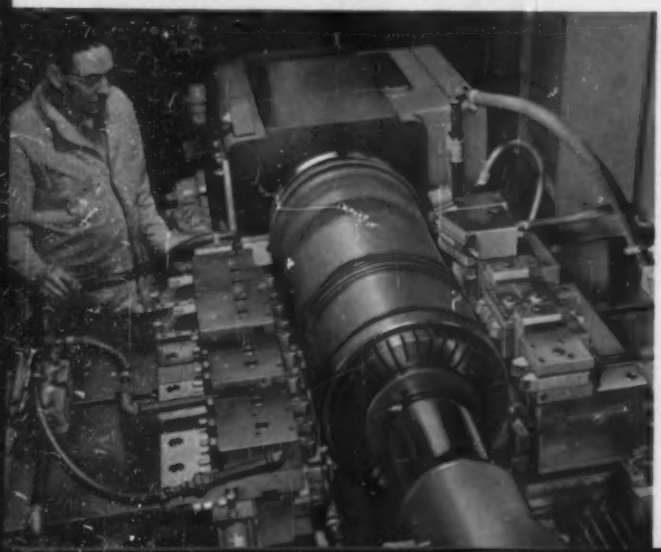
Here's how an automatic lathe gives you maximum efficiency in machining multiple surfaces on long parts. First, and most important, is that the machine itself offers the right combination of capacity, horsepower, rigidity, versatility and quick change-over to cut costs.

These were the factors involved in Ingersoll-Rand's decision to purchase a Gisholt MASTERLINE No. 24 Automatic Lathe for cylinder liner machining in their plant at Painted Post, New York. The machine shown, is a second No. 24 recently ordered to meet increased production needs.

Work includes liners from 24¾" to 43" in length, 18" to 21½" diameter, in lots up to 100 pieces. Up to 20 O.D. surfaces must be rough- and finish-machined.

The work is supported on expanding mandrels at headstock and tailstock. Front and rear carriages are extra wide. Each carriage supports two independent tool slides, linked together to operate as a unit. Separate setups are made for roughing and finishing. The slide tops are accurately marked for fast positioning of blocks with preset indexable tip tools. Size adjustment is provided for each tool. Cam-operated tool blocks, actuated by forward movement of the carriage, are used where tapers are required.

A 100 h.p. motor and the rugged No. 24 headstock permit simultaneous engagement of all 22 tools for the roughing operation on the 20½"-diameter, 43"-long liner shown. These tools turn, taper-turn, blend, face, groove and chamfer. Setup is similar for the finishing operation. Machine rigidity permits holding tolerances of +.005" to −.000" on the 43"-long parts.



Twenty-two tools machine 20 surfaces during the automatic roughing cycle. Up to 30 pieces are completed per tool despite heavy stock removal.

No. 24 saves time, improves accuracy over entire work range. It offers capacity and flexibility for maximum savings on large parts.

For information on No. 24, circle No. 745 on inquiry card.

SUPERFINISH® SAVES TWO OPERATIONS FOR SKF

Eliminates grinding, finishes a face and a diameter at the same time

Superfinish offers a lot more than a fast, automatic cycle that produces a "controlled" surface finish at minimum cost. Other important benefits that will assure top management approval when making your new equipment requests are demonstrated by this setup used by SKF Industries, Inc.

Benefit No. 1—Eliminates and combines operations

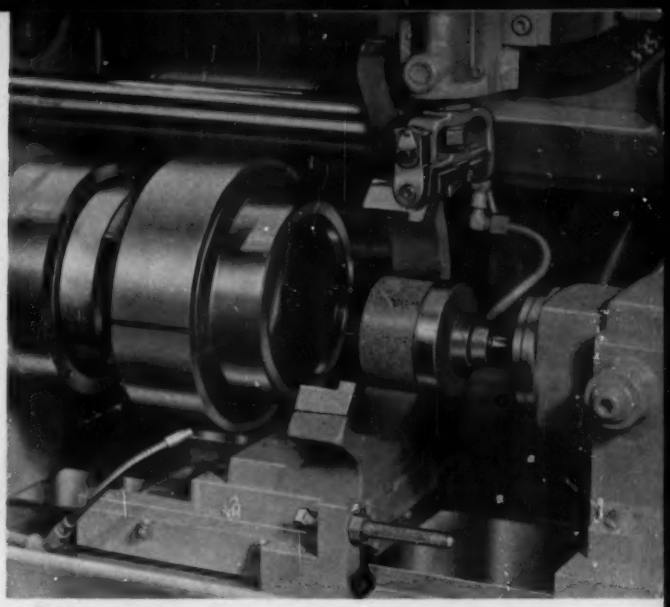
Here a Model 51A Superfinishes two surfaces on cast iron railroad axle caps. These surfaces are first machined, then Superfinished. Grinding is eliminated. The upper stones engage the seal diameter and remove .003" stock while reducing the surface from 150 to 20 micro-inches RMS. *At the same time*, the cup wheel on the rotary quill Superfinishes the induction-hardened roller thrust face from 150 to 15 micro-inches RMS. A .005" taper is also created on the thrust face.

Benefit No. 2—Improves surface quality for longer service life

Minute peaks that cause excessive wear or galling are removed. The true bearing area is increased as much as 80%. Some valleys remain to retain lubricant. Load capacity is increased substantially.

Benefit No. 3—Versatility and quick setup

SKF uses one machine to Superfinish both flat and cylindrical surfaces on axle caps, enclosure collars and sleeves in a variety of sizes. Expanding mandrels and face-plate fixtures hold the work. Stone pressure, reciprocation rate, rough and finish spindle speeds, and cycle times are quickly set for each part. Quick-change stone holders further simplify the operation. Longitudinal traverse for long diameters is available.



Axle cap shown in mandrel. Note loading and locating fixture at front center. Stones on overhead quill Superfinish 6.750"-diameter, 1-21/32"-wide seal surface, while the cup wheel, on a rotating quill, advances to Superfinish the roller thrust face. Two operations performed in one chucking.

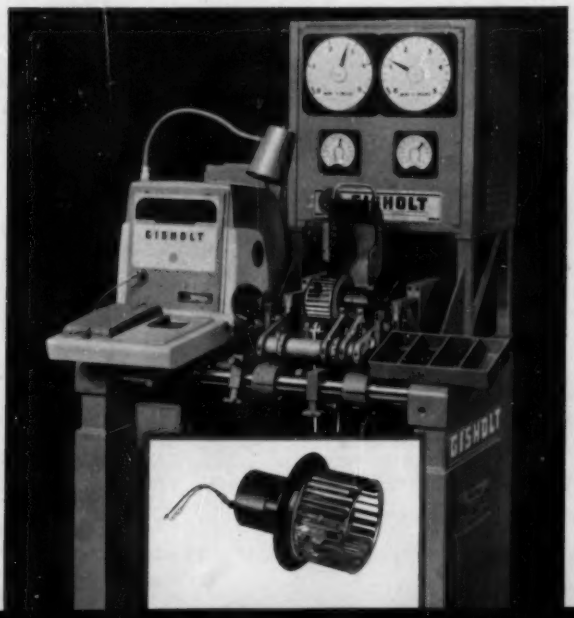
Superfinish cuts previous finishing time in half on part shown, saves in other three major areas. Contact Gisholt for a complete analysis of possible savings on your work.

For information on Superfinishing, circle No. 746 on inquiry card.

HOW YOU CAN SIMPLIFY PRODUCTION BALANCING

NEW ideas reduce work handling, speed production, eliminate chance of error

This setup on a 1S Balancer may point the way to new speed, efficiency and accuracy in your own balancing operations. Featuring several new ideas, this 1S locates, measures, corrects and inspects balance of blower assemblies for automotive air conditioners—all in one fast cycle. A battery of 13 such machines is cutting costs for a well-known eastern automotive components manufacturer.

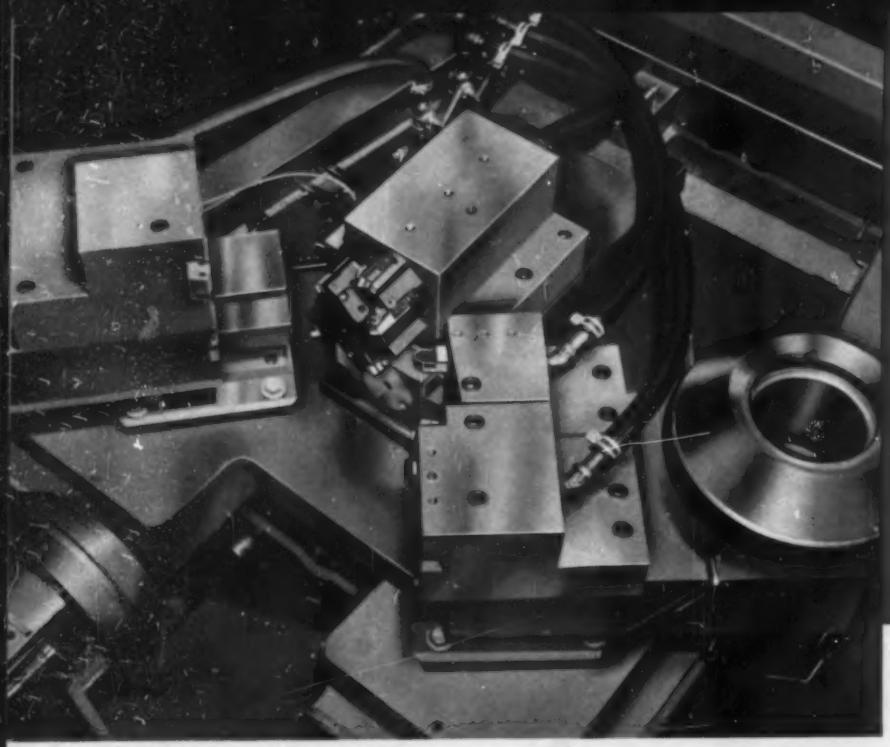


Operating and work-handling time is cut to a minimum by: a direct-loading supporting fixture which works without clamps or half-bearings; a belt drive under the work which eliminates belt-handling; a slip-on scanning cup which eliminates the usual numbered angle reference tape or protractor on the work; a single "left-right" switch which quickly indicates angle and measures amount of unbalance in each plane; separate unbalance location (angle) and amount meters that "hold" readings until corrections are made—one set for each correction plane; automatic starting and stopping of work rotation by raising and lowering of protective shroud. Guesswork is eliminated since meters provide exact indications in terms of correction method used.

Before loading, operator places a scanning cup inside the fan on the hub. Aluminum clips (various weights in tray) are crimped to the vanes at indicated angles in each plane to correct unbalance. The amount meter shows the clip size required to correct within a 1/64 oz. in. tolerance. With this setup on the Gisholt 1S Balancer, one operator locates, measures, corrects unbalance and inspects 74 blower assemblies per hour.

New ideas speed and simplify balancing—eliminate need for operator to remember angle and amount of unbalance in each correction plane.

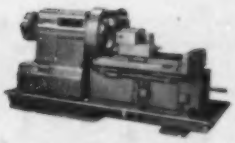
For information on 1S Balancer, circle No. 747 on inquiry card.



Bevel pinion is held on an expanding mandrel. Platen advances tools to work and holds while front slide straddle-faces back angle and face; center slide co-bores; rear slide faces front angle. Time: 3.3 minutes, f.t.f.

THE AUTOMATIC WAY TO HIGHER PROFITS ON YOUR PARTS

Simplimatic® offers "one-pass" completion of second-operation work



Whether you machine bevel gears or not, you can benefit from the ideas used in this setup. It shows how a Gisholt MASTERLINE Simplimatic, a single-spindle automatic lathe, can be tooled to machine a maximum number of surfaces per chucking—providing consistent quality at fixed production rates — leaving the operator free to handle a second machine.

The overhead view of the tooling used in the second operation on steel bevel pinion forgings demonstrates the versatility of this machine. Note the wide platen. Retracted, it provides ample clearance for loading and unloading. The platen is screw-fed and carries the tools to and from the work. It can rapid-traverse, and then hold while the slides operate. It can also rapid-traverse, then feed forward to plunge facing tools to depth; it can bore or position tools in a bore for straddle facing, internal grooving, etc., before standard slide movements begin.

In this setup, front, center and rear independent slides operate simultaneously. All are positioned so that when the platen advances to machining position, they will be close to the work, at the proper angles, and will have minimum tool overhang.

A 40 h.p. motor permits heavy stock removal (angle facing cuts at 250 s.f.m. and .015″ feed, up to ½″ stock removed per side). Machine and tooling rigidity assures accuracy on angles and good surface finish.

For your own work, a tailstock, a separate motor-driven speeder boring bar, a single- or multiple-pass JETracer® slide or an auxiliary slide can be mounted on the platen. A back-facing or back-boring attachment can be operated through the spindle—permitting simultaneous machining of front and back surfaces.

A basic set of tooling can generally be provided to handle a number of work sizes—even parts of quite different configuration—with minimum time for change-over.

Versatile Simplimatic does the work of special machines at standard machine cost. Platen permits unlimited variety of tool slide arrangements for machining maximum number of surfaces per pass.

For information on Simplimatic, circle No. 748 on inquiry card.

Ask about Gisholt "Productivity Team"

Almost any part can be handled at peak efficiency with a "Productivity Team" consisting of an automatic turret lathe and single-spindle automatic. With fast, new setup and change-over advantages, they are now practical for small lots as well as for large production runs.

Gisholt now offers automatic turret lathes in six sizes and four single-spindle automatics. Call your Gisholt Representative. Let him show you how a new Gisholt "Productivity Team" can cut costs on your work.

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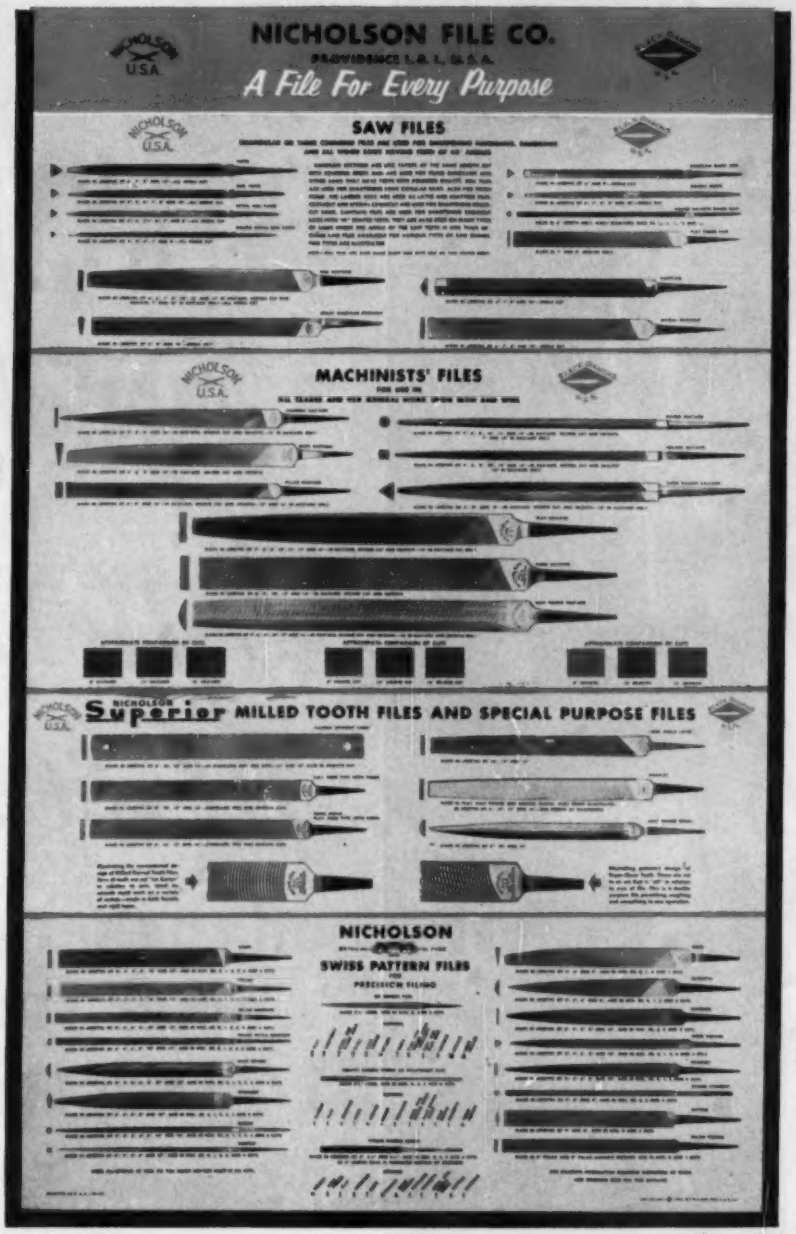

NICHOLSON HELPS YOU SELECT-A-FILE WITH THIS FREE WALL CHART

Here's a concise summary with suggested uses of the most popular Nicholson files. It shows cuts, sizes, shapes of Saw files, Machinists' files, Superior Milled Tooth files, Special Purpose files and X. F. Swiss Pattern files.

The chart's designed to help you and your employees select the right file for the job. Convenient for ordering files, too. Available free from Nicholson File Company. Just clip and fill out the coupon below.

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NEW "PIVOTING" MOTOR MOUNT—assures proper belt tension for maximum torque transmission, longer belt life.

This new machine incorporates so many other built-in quality features that can help lower your production costs, you'll want to see it in action. Visit your Walker-Turner Distributor (he's listed under "MACHINE TOOLS" or "TOOLS" in the Yellow Pages). Learn for yourself why more people in metalworking call Walker-Turner the *value* line.

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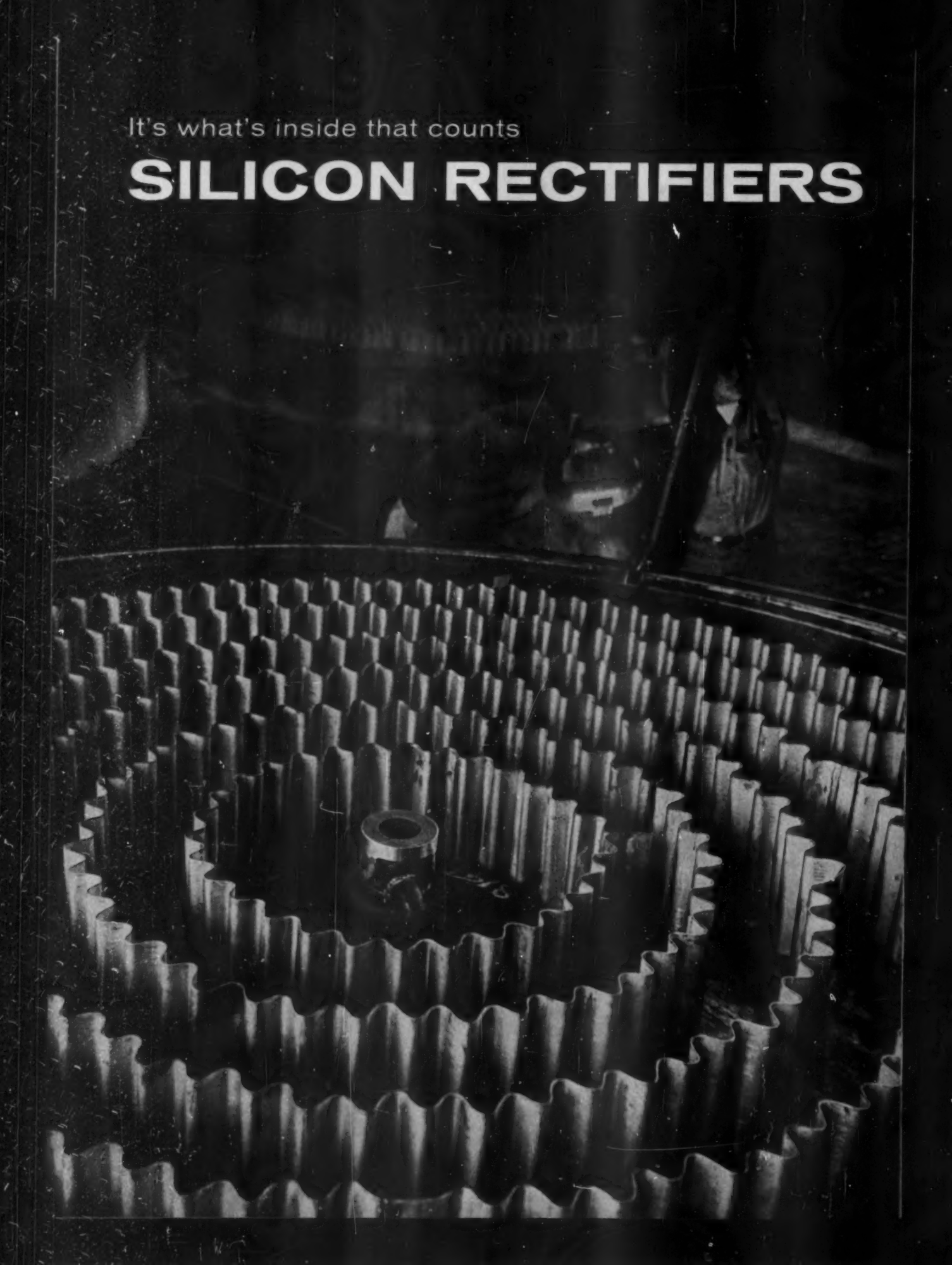
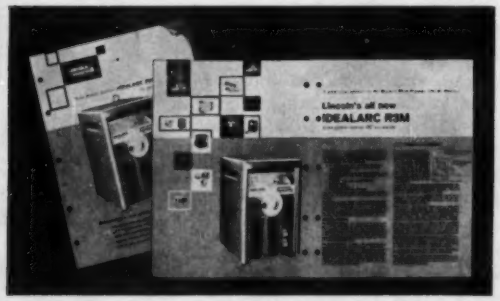


DON'T DETERIORATE

Because there is no gradual breakdown of a silicon diode, every LINCOLN Idealarc R3M three-phase rectifier welder will give top performance throughout its entire life. Here are the reasons why your welders should have silicon rectifiers.

Silicon rectifier diodes like this, used exclusively in the Idealarc R3M, are four times as efficient as selenium—increase welder efficiency—reduce power loss. Other important power considerations: balanced three-phase line draw—no starting surges—low idle current, about 15% of rated input.

Note the minimum spatter in this photo. Here, and in the picture on the opposite page, annealing furnace bases of 309 stainless steel are being welded. The Idealarc R3M's steep volt-amp curve insures minimum spatter while unique electrical design gives smoothest possible arc characteristics, both highly desirable in stainless steel welding.



The Idealarc R3M is available in sizes from 300 to 650 amps. For full details covering applications, performance features, construction, specifications, optional features and prices, write for Bulletin 4609.1. The Lincoln Electric Company, Dept. 1611, Cleveland 17, Ohio.

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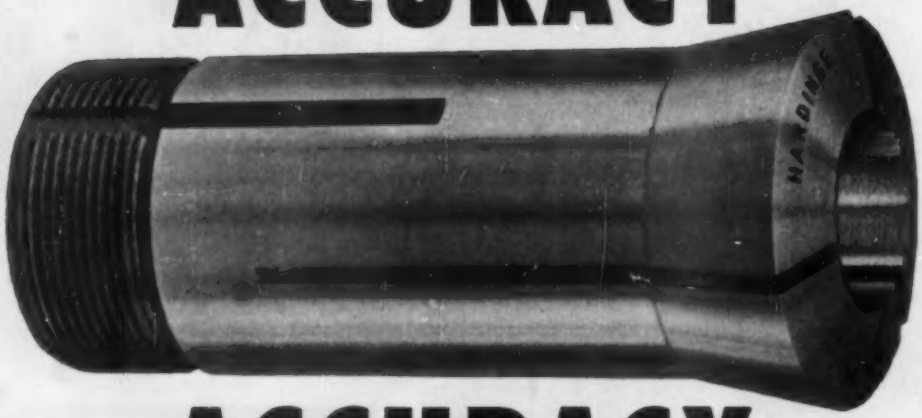

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BATH *Tap'n Gage* TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 6

Subject: Tapping the Difficult to Machine Materials:

The "missile age" has brought about the development of new materials designed to withstand the extreme stress, heat and strength problems inherent in jet engines, high speed aircraft, missiles and similar military hardware. These materials are classed as "difficult to machine" in comparison with the common types of steels, irons and light alloys.

General Tapping Data

It is essential that all of the rules for good machining practice and tapping procedure be followed. Initial design specifications for threaded holes should favor the tap wherever possible. A copious supply of coolant must be provided and the coolant temperature should be maintained as low as possible. Tapping speeds should be reduced considerably in comparison with ordinary practice.

Titanium and Titanium Alloys

The basic characteristics of this material are low volume specific heat and low thermal conductivity. These thermal properties are best combatted by reducing the rate of heat generation. In tapping, heat generating friction is minimized by eccentric relief in the threads, additional chamfer relief, interrupted threads and increased back taper.

Hand taps with the standard number of flutes and chamfers of 4 to 8 threads have proved satisfactory. Bottoming holes may require series or sets of taps. Spiral pointed taps are satisfactory for through holes not exceeding 2 diameters.

Abrasive wear and galling can be reduced by case surface and oxide treatments. Tapping speeds vary from 40 SFM for the softer grades down to 10 SFM or less for the toughest grades. A maximum 65% of thread height is suggested and cutting fluid should be an activated sulpho-chlorinated oil. If standard taps are not satisfactory, Bath Type "R" or "RR" are recommended.

High Tensile Steels (Super-Strength Steels)

The basic characteristic of these materials is the hardness after heat treating which ranges up to 58 Rockwell C. Tapping difficulties vary with the analyses even though Rockwell readings may be the same. Tap recommendations for these materials must include careful consideration of cut per tooth. Taps with four flutes and 6 to 8 threads chamfer have given best results. A cutting face angle which is approximately radial (0° rake) should be used. Tapping speeds should not exceed 10 SFM and cutting fluid should be activated sulpho-chlorinated oil, generously applied. If standard taps are not satisfactory, the use of special high Rockwell high speed steels such as Bath "N Steel", will be required.

High Temperature Alloys (Superalloys)

The basic characteristic of these materials is their tendency to work harden. Hardness and resistance to cutting varies with each alloy group. Cutting speeds and tap design must be tailored to the particular alloy. A cutting face hook of from 0° to 10° should be used. The harder the material the lower the hook. Chamfers should be from 3 to 5 threads and thread relief should be used to reduce work hardening due to rubbing. Tapping speeds must be kept low and in extreme cases are in the 5 to 10 SFM range. Thread height should be kept as low as possible and activated sulpho-chlorinated cutting oil is recommended. If standard tap materials are not satisfactory, Bath "N Steel" will be required.

Stainless Steel

Free machining grades are not much more difficult to tap than ordinary mild steels. The difficult grades require taps designed with free cutting characteristics. Thread relief, interrupted threads, hook angles of 8° to 12°, increased back taper and certain surface treatments help to reduce friction. Spiral pointed taps give good results where applicable. Tapping speeds are in the range 10 to 40 SFM and activated sulphorized and chlorinated oils are the most generally used coolant. If standard taps are not satisfactory Bath Type "R" should be specified.

For further information on this subject, fill out and mail attached coupon with 25¢ for technical brochure "Milling, drilling and tapping the difficult to machine materials" — published by the Metal Cutting Tool Institute.

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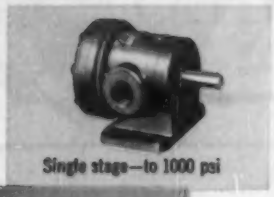

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LETTER from the PUBLISHER

What This Is All About

In the belief that you will be interested in knowing more about what we are doing to make AMERICAN MACHINIST/METALWORKING MANUFACTURING more exciting and useful, we will be talking with you in this spot from now on in every issue.

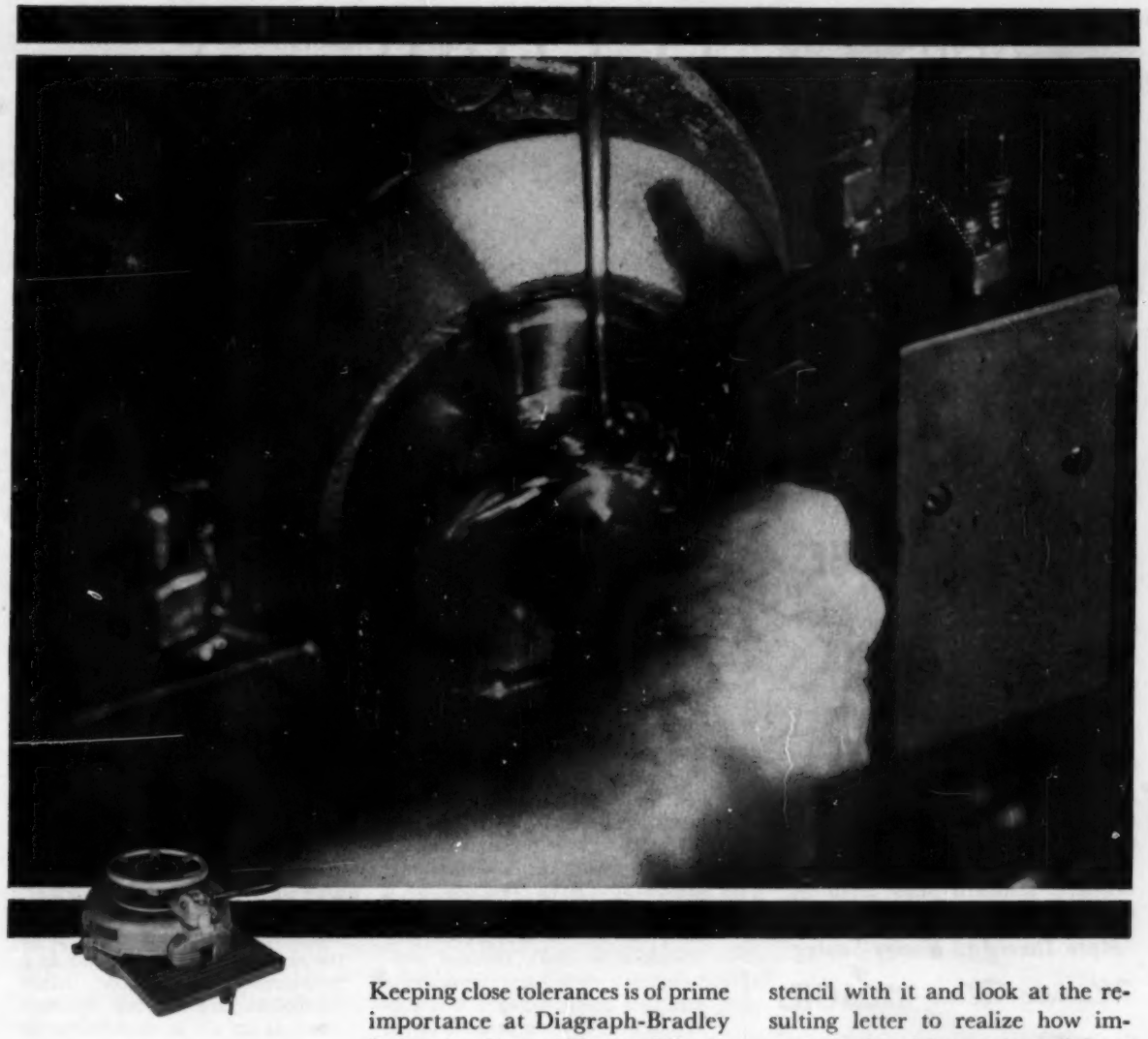
To do your job better . . .

AM/MM is edited to help you do your job better and to bring you news of Metalworking that affects you. It is YOUR magazine. You are the most important person of all to us. We feel that we have a contract with you . . . to keep you on top of all the major developments in metalworking manufacturing. That's why we urge you to read every issue. Get the AM/MM reading habit! Your basic aim undoubtedly is to make your product efficiently at the lowest cost. You naturally then wish to be posted continuously on the most up-to-date production techniques and on the newest production equipment, materials and component parts. The task of keeping you informed is ours—to do it in such a way that you will be able to apply the ideas that you read in AM/MM right to your own business.

Many changes made . . .

We hope that you like the changes we have been making. Metalworking Report, started more than two years ago, is being written so that you can get the facts fast in easy-to-read fashion. New Materials, because of its growing importance, has been put into a department of its own. The every-issue "Profile" of a prominent Metalworking man, just recently introduced, already has stirred favorable comment. These are only a few of the changes and improvements. In succeeding issues we will report to you on many others.

George Reppert



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Cities Service Chillo 10 oil is a sulphochlorinated oil. The concentrations of sulphur and chlorine are stabilized by a special process, assuring uniformity of action through the entire cutting operation.

That's why, with Cities Service Chillo 10 cutting oil, work is always more accurate, clean and cool!

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Hexagon Broaches, for holes from 1/8" Hex to 3/4" Hex, offer the same production advantages as square broaches.

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LETTERS

to the editors

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Retooling for Compacts

Dear Sirs:
Kindly advise me the cost of 100 reprints of your article, "Auto Lines Retool for the Compacts" (*AM/MM*—Oct 3 '60, p109).

V F Roszko
Plainfield, NJ

Copies of this Special Report are available from our Reader Service Dept at 35¢ per single copy; 33¢ per copy in lots of 100 or more—Ed.

Rebuttal on Visual Charts

Dear Sirs:
There is one paragraph in your highly comprehensive "Guide to Production Control" (*AM/MM*—Sept 19 '60, p125) which has captured our attention:

"Another way to generate unnecessary work is to use mechanical aids such as visual charts. Such boards may be valuable as visual aids, but they also represent duplication of effort, because anything on a visual representation is also on a piece of paper. Our survey of over 500 companies showed that over 75% of the firms that bought such devices are no longer using them in the way originally planned."

You can understand our special interest if you know, as you well may, that our largest selling product since 1943 has been the Wassell Produc-Trol board. Produc-Trols have been sold to some 30,000 companies, plus hundreds of Government installations, both civilian and military, and they continued to be bought and put into use at a very lively pace.

We are well aware, of course, that in numerous cases, Produc-Trols are no longer being used "in the way originally planned." However, this fact does not, by any means, necessarily connote retrogression; in many cases production supervisors make very substantial improvements in their original applications.

It is of course also true that, as in the case of almost any product, some installations of Produc-Trols have been abandoned altogether, for a variety of reasons. In some cases, the cause apparently is in the area of automation. But as a counterbalancing factor, other companies are buying Produc-Trols as an aid in such things as

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N. Jarvis

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N. JARVIS

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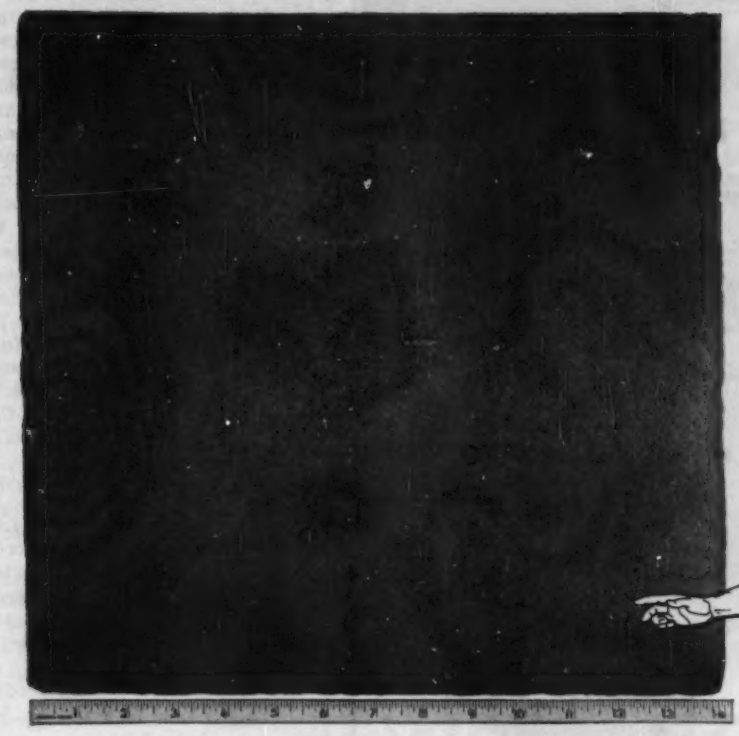


This mark tells you a product is made of modern steel.

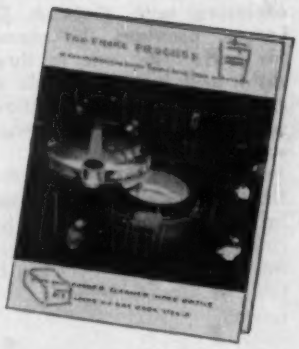
This is an etched portrait of FINKL Vacuum Degassed Steel

The photo above shows a 14" x 14" etched slice of E4340 steel cogged from a 23" ingot weighing 8000 pounds. The dense, homogeneous, electric furnace steel is the result of a double slag practice, and vacuum degassing in the ladle with helium purging.

Increased ductility, toughness, freedom from the danger of flake, and improved cleanliness are assured by degassing which removes two-thirds of the hydrogen and one-half of the oxygen. Machineability is also improved because of the lower content of oxygen and oxidic inclusions.

All Finkl die blocks and hot work steels are vacuum degassed to bring you more production, less downtime due to breakage, better machineability with fewer tool regrinds, and higher luster in the impression.

You get more from Finkl in quality products, continuing research, and engineering service. Call your Finkl representative for your forging, die block, and hot work die steel needs.



Write to Dept. A, on your company letterhead for free BULLETIN 300. It shows the Finkl Process of vacuum degassing steel with all its advantages to you.

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This NEW development—unsurpassed for speed, convenience of tooling and precise finish—involves no retooling problem even for short runs. It assures greater production at lower cost on all classes of work.

The unique "1-2-3" feature, exclusive with Goss & De Leeuw, provides the means for performing one to three right or left hand single or double threading operations simultaneously or in sequence, without changing set up.

Here's an ideal machine tool for small lot requirements because of quick, easy changeover. Any class of chuck work can be handled economically in any quantity.

The examples of work shown here are typical of the wider variety of parts being produced on these new machines.

SEND FOR

detailed information on this new machine. Let us have samples of your work in order to give you time and cost estimates for handling it on the "1-2-3" Goss & De Leeuw.

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MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

scheduling computer input.

Of course, we do not doubt the author's sincerity, but isn't it possible that the survey on which he apparently based his conclusions, in part, unfairly imposes a blanket condemnation on all visual charting—and unfairly disregards the fact that visual charts differ quite widely?

We can't prove it, of course, but we have strong indications that the mortality among some types of boards has been vastly greater than has been the case with Produc-Trol.

John C Ottinger,
dir of public relations
Wassell Organizations Inc
Westport, Conn

Tool-Life Formula

Dear Sirs:
On your "Spot News" page (*AM/MM*—Nov 14 '60, p91), there is an announcement of a new tool-life formula developed in Sweden. Can you give us any further information about this or tell us where we might get such?

M Cardigan
Boston, Mass

Dear Sirs:
We are interested in obtaining additional information regarding the new tool-life formula developed by Dr Colding . . .

F Winde
Dertoit, Mich

We are developing a more complete explanation of Dr Colding's formula and plan to publish it as soon as possible—Ed.

"Guess by putting Johnson at this end, he'll stop his clock-watching."

CALENDAR

Instrument Society of America—Instrument-Automation Conference & Exhibit, Jan 17-19, Kiel Auditorium, St Louis, Mo

Plant Maintenance & Engineering Show—Jan 23-26, Palmer House and International Amphitheatre, Chicago, Ill.

Society of Plastics Engineers—Annual Technical Conference, Jan 24-27, Shoreham Hotel, Washington, DC.

Society of the Plastics Industry Reinforced Plastics Div Conference, Feb 7-9, Edgewater Beach Hotel, Chicago, Ill.

Material Handling Institute — Pacific Coast Show, Feb 22-24, Cow Palace, San Francisco.

American Institute of Mining, Metallurgical, & Petroleum Engineers—Annual Meeting, Feb 26-Mar 2, Chase-Park Plaza Hotel, St. Louis, Mo.

Society of Automotive Engineers National Automobile and Production Meetings, Mar 13-17, The Sheraton-Cadillac, Detroit.

American Society for Metals — Western Metal Show, Mar 20-24, Pan-Pacific Auditorium, Los Angeles, Calif

Pressed Metal Institute — Spring Technical Meeting, Mar 22-24, Belmont Plaza Hotel, New York.

American Machine Tool Distributors Association—Spring Meeting, Mar 23-25, Hotel Mark Hopkins, San Francisco, Calif.

Society of Automotive Engineers —National Aeronautic Meeting, Apr 4-7, Hotel Commodore, New York, NY.

American Welding Society—Annual Meeting and Welding Show, Apr 17-21, Commodore Hotel and Coliseum, New York.

American Society of Mechanical Engineers—Metals Engineering Conference, Apr 23-26, Penn Sheraton Hotel, Pittsburgh, Pa.

American Foundrymen's Society —Castings Congress & Exposition, May 8-12, Brooks Hall and Civic Auditorium, San Francisco, Calif.

WEDGMOUNT LEVELING MACHINERY MOUNTS

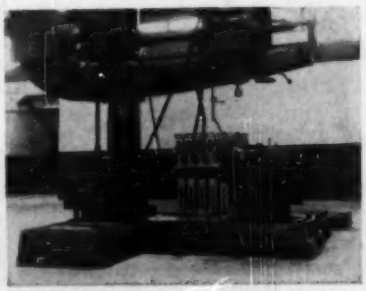
You can now effectively dampen and isolate the vibration, shock and noise of any machine with Wedgmount machinery mounts.

Wedgmounts are manufactured in a wide range of sizes and capacities so that it is possible to control the vibration of any type of machine tool — from punch press to grinder.

Wedgmounts are installed without bolts or cement and installation takes but a matter of minutes. Because of their opposing wedge construction, Wedgmounts are easily leveled by means of an adjusting bolt — no need for shimming.

Other models, retaining the leveling feature, are available to use where bolting to the floor is mandatory, or where it is desired to make the mount an integral part of the machine.

Write for full information about Wedgmount leveling machinery mounts. Or, plan to stop in at our booth at the Plant Maintenance and Engineering Show, Chicago, Jan. 23 — 26, 1961.



* The photograph above is from an actual Wedgmount installation. It is one of eight 4" x 8" Type S Wedgmounts supporting a Cincinnati-Bickford 6 foot radial drill, shown at left.

Air-Loc® DIVISION

Clark, Cutler, McDermott Co.

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Hughes two-axis control system, with positioning table, can be retrofit to almost any kind of drilling machine—single or multiple spindle—or to any other type machine requiring two-axis positioning.

Hughes numerical controls will reduce lead time, eliminate complex jigs and expensive tooling, and increase the productivity of your machine. And, they are easy to operate and service!

The Hughes Positioning Table is automatically operated from pre-programmed taped instructions. The table positions at a rate of 150 inches per minute; has repeatable accuracy to within 0.0002". Measuring circuit and drive motors are fully integrated.

Installation of this proven system is simple and fast. In many cases, all it takes is one day.

To find out more about how Hughes numerical controls can increase your profits, write, teletype (TWX INGL 4117) or call collect: Hughes Industrial Systems Division, P.O. Box 90904, International Airport Station, Los Angeles 45, California. For export information, please write: Hughes International, Culver City, California.

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NOW! a numerical control package that can be retrofit to your present machine tool

SPOT NEWS...

- **The newer compacts introduced by the Big Three are setting a slower pace** than the original Big Three compacts did a year ago. Up to the Christmas holidays production of the Dodge Lancer, Buick Special, Olds F-85 and Pontiac Tempest totalled 152,899. In a similar period last year, with output held down by the steel strike, production of the Falcon, Valiant, and Corvair had reached 185,514 units. Higher prices appear to be a major factor.

- **European Coal and Steel Community steel production exceeded U S production** by 200,000 tons during the third quarter of 1960. This reportedly is the first time since World War II that steel production of these countries (West Germany, France, Belgium, Luxemburg, and The Netherlands) has been greater than that of the U S. Third quarter production by the ECSC reached 18 million tons, of which 8,890,000 tons was from West Germany.

- **22 types of machine tools will be built in India's second heavy machine-tool** building plant at Ranchi (Bihar State), which is being built with assistance of Technoexport of Czechoslovakia. Six models of center lathes, 3 of planers, 4 of horizontal borers, 3 of vertical boring and turning mills, 2 of planer-millers, 2 of grinders, and 2 of radial drills will be built. Plant is scheduled to produce 80,000 tons of machine tools a year.

- **A long term plan for leasing metalworking machinery** is offered by Nationwide Leasing Co, Chicago, Ill. Leases for six to twelve years are available for as little as $25,000 worth of equipment. To qualify, companies must have a tangible net worth of at least $1 million, show a five-year record of profitable operations, and lease equipment which has a life expectancy greater than the lease term.

- **Equipment can be leased for terms as short as six months** under a plan developed by National Equipment Rental, Ltd, Floral Park, Long Island, NY. The plan grew out of an inquiry about leasing $250,000 worth of equipment to stock an entire machine shop. The plan is designed to solve the equipment dilemma of companies whose government contracts may be abruptly cut back or cancelled. Service is available to sub-contractors as well as primes, and for R&D equipment as well as production and service machinery.

- **The problems of selling to the government are analyzed in a new book,** *Procurement and Profit Renegotiation,* edited by J Fred Weston, professor of business economics and finance at UCLA. Book is published by Wadsworth Publishing Co, San Francisco, California.

- **New process for casting tool steel ingots** is said to eliminate central carbide segregation, the central pocket of carbide which tends to form when cast steel ingots are cooled by conventional methods. This weakness formerly had to be dispersed by working. Process was invented by William Kelsey, a director of Inca Steel Co, Ltd, Sheffield, England.

- **Numerical control saved the Army $25,898** in the production of a cast-steel bracket for a gun mount. Conventional manufacturing required five fixtures, 149 hr of tool design, 336 hr for tool manufacture, 11½ hr of setup time, and a little over 3 hr machining time. With a tape-controlled machine the Army's Rock Island Arsenal cut tool design to 15 hr, tool manufacture to 68 hr, setup to 4 hr, machining to less than 1 hr. Programming took only 16 hr.

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WASHINGTON...

Military budget outlook . . .

In its final weeks in office, the Eisenhower administration reluctantly approved an additional $400 million in defense spending for fiscal 1962 which starts July 1. This will bring total outlays for the new year to $42.9 billion, up $1.4 billion over the current rate of spending.

The Budget Bureau originally planned to hold the Pentagon to the present level of expenditures next year under the Eisenhower goal to balance his final federal budget. But a few months back the Bureau gave in to Pentagon pressures for a budget increase and approved a $1-billion increase. Then, in the few weeks before the final budget figures were set, outgoing Defense Secretary Gates squeezed out approval for the extra funds, arguing that the money was needed to prevent stretchout or curtailment of projects under way.

Spending for major weapon hardware production is now slated to rise from the current $13.8-billion level to well over $14 billion. The expenditure rate reflects the volume of equipment shipments.

Missile production spending will top the $4-billion mark for the first time next year as output of Atlas, Titan, and Polaris ballistic missiles goes into high gear. Shipbuilding expenditures will stay close to the current level of $1.7 billion.

Expenditures for weapons research, development, test, and evaluation will rise some 10% over the current $4.1-billion rate. The increases will be earmarked for missiles, electronics, and satellite projects.

Final Eisenhower cuts . . .

In terms of new appropriations, the final Eisenhower defense budget calls for big boosts for the Air Force's Minuteman ICBM and B-70 bomber projects. The new money request for the Navy's Polaris will be close to this year's appropriation level.

No new funds will be sought in the Eisenhower budget for the Air Force's Skybolt ALBM, the Navy's Missileer interceptor aircraft, or the Air Force's B-52 and B-58 bombers. The first three projects, however, will be continued during the new year with funds carried over from the current appropriation.

Kennedy to revamp budget . . .

The odds are strong that the incoming Kennedy administration will boost the Eisenhower defense spending plans. The new Secretary of Defense, Robert S. McNamara, is already reviewing the figures and projects in the Eisenhower version of the new Pentagon budget.

But few if any officials here expect the increase to come close to the $2.5-billion to $3-billion sum Kennedy cited during his election campaign as the amount that was needed to beef up the Pentagon.

In terms of actual expenditures, it's unlikely the new administration could hike current spending by more than $500 million or so. The added outlays could be made by stepping up the level of effort in research projects. Accelerating deliveries of production items would take longer and probably wouldn't show up as extra spending this fiscal year.

Boeing renegotiation case to resume

The U S Tax Court trial on Boeing Airplane Co's appeal from a Renegotiation Board ruling that the company made $9.8 million in excessive profits before taxes in 1952 will resume here this month.

The case is the biggest renegotiation appeal by a defense contractor ever to come into court, and puts into the sharpest public focus ever the fundamental issues of the controversial law. The trial has dragged on for more than three years, has been in recess for almost two years.

In the past month, a U S District Court judge in Washington submitted a final ruling on Boeing's attempt to see government records relating to the case — a legal maneuver which has delayed the trial up to now. The government has fought Boeing's move, arguing that such papers are a matter of executive privilege and need not be released.

The judge supported the government claim that all internal Renegotiation Board documents related to the "decision-making process" are matters of executive privilege. But he ordered the government to allow Boeing to see Air Force reports to the board on the company's contract performance—one of the criteria for board determinations of excessive profits.

Lawyers on both sides claim a court victory on the issue. This is the first time that a renegotiation appellant will have access to any official papers. Government spokesmen, however, say they will have to go to court to obtain access to official documents regarding board decisions.

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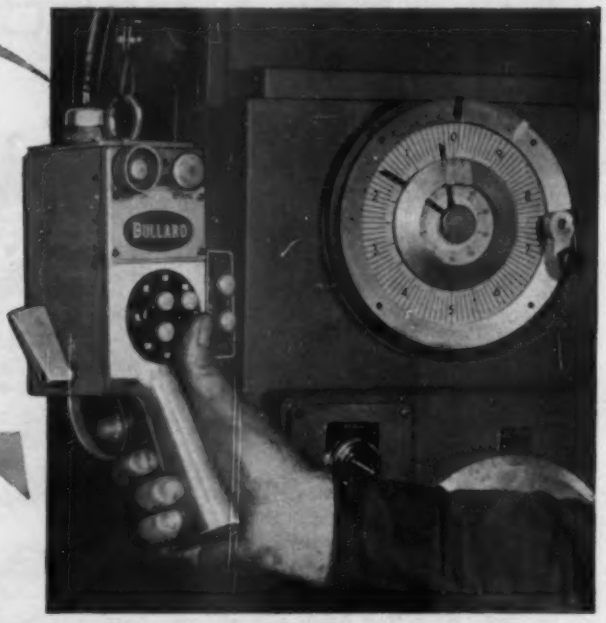

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DETROIT...

Through the typewriter . . .

Each year some 40 auto writers gather at a Christmas luncheon sponsored in Detroit by the Automobile Manufacturers Association and predict domestic automotive production for the coming year.

Although some individual estimates stray far afield, the average of the guesses has proved remarkably accurate. For example, last year when the crystal ball was clouded by the yet-to-be-determined sales performance of the compacts, the group guessed 6,577,000 cars and 1,200,000 trucks and busses. As of December 24, actual production for the year stood at 6,614,-829 cars and 1,184,237 commercial vehicles.

While not always as close as the 1960 survey, the average of the guesses has invariably predicted trends. Thus, without further comment, we pass on the results from the latest session: 6,133,000 passenger cars and 1,064,000 trucks and busses will be built during calendar 1961.

Compact woes . . .

With compacts now accounting for 35% of production and seemingly destined for an even bigger bite in 1961, suppliers and auto companies alike are facing dwindling profits.

Here is how it affects steel. 65% of an auto, by weight, is made up of steel, and in a normal year the auto industry consumes about 20% of the total steel output. With this in mind, look at a weight comparison between the current Comet and Mercury. Comet sales pushed this maker to a next-to-record sales year, but the Comet 4-door sedan weighs 2518 lb at the curb. A comparable model Mercury weighs 3873 lb. Thus it can be seen that three Comets can be built with the steel required for two Mercurys, and the Comet is now outselling its parent.

Dodge, for the first time in a decade of industry silence, has published figures indicating the material breakdown in a typical car. Steel we have given above. Other machinable metals include iron, 18.9%; aluminum, 2.1%; cuprous alloys, 1.9%; and lead, 1.1%. Suppliers of these, whether in raw or finished form, are now subject to the same basic weighted discount when the products are used in compacts. Take each of these materials and figure that three compacts can be built from a stockpile that formerly served two cars.

A probable exception is aluminum, which can only stand to gain from the emphasis on lower weight. In 1955 an average of 30 lb of aluminum was used in each car; in 1961 usage has climbed to 66 lb, due largely to the advent of nonferrous engine blocks. By 1970, it is predicted by Reynolds Metals Co, 120 lb of aluminum will be the average for each car. However, much of this will be at the expense of the grey iron content.

Compact horizons . . .

One market fact that offers a ray of hope to suppliers is the paradoxical public preference for deluxe compacts. A majority of all compacts sold are top-of-the-line models, which sell for a price well within the range of the most austere standard-size cars.

Corvair offers a "Monza" model, at a price nearly $280 above its stripped counterpart, and Chevrolet has trouble meeting demand. It recently expanded this trim option—for that's all the difference amounts to—to the 4-door sedan. Surprisingly, the Monza started as a special auto show model with production possibilities strictly tongue-in-cheek.

Ford's experience with its Falcon is somewhat similar. 65% of buyers specify a $78 deluxe trim kit, and a closely parallel percentage is recorded in the Comet model mix. V-8 engines are a popular option with those compact makers who offer them.

Nevertheless, even a deluxe compact does not offer maker or supplier the profit margin of a standard size car. As a case in point, it is well known in industry circles that Ford Motor Company figures 1-million units as the break-even point with its standard size Ford. The company did not quite make this nut in 1960 because 400,000 buyers chose Falcons in lieu of the big car, or at least that is the figure that big car sales are down from in 1959.

S-P goes ahead on new Lark...

The Studebaker-Packard board of directors that elected Sherwood H Egbert, 40, president also voted to go ahead with tooling plans for an extensively restyled 1962-model Lark. Plans for the 4-cylinder, 100-in.-wheelbase smaller car, however, were once again postponed.

This car would have been powered by a liquid-cooled, 4-cylinder engine mounted in the conventional position. Because of the lack of machine-tool orders for the engine program, it is assumed that the engine is the current Studebaker V-8 block slashed in half lengthwise. As with the Pontiac Tempest 4-cylinder program, this design permits many economies.

—Don MacDonald

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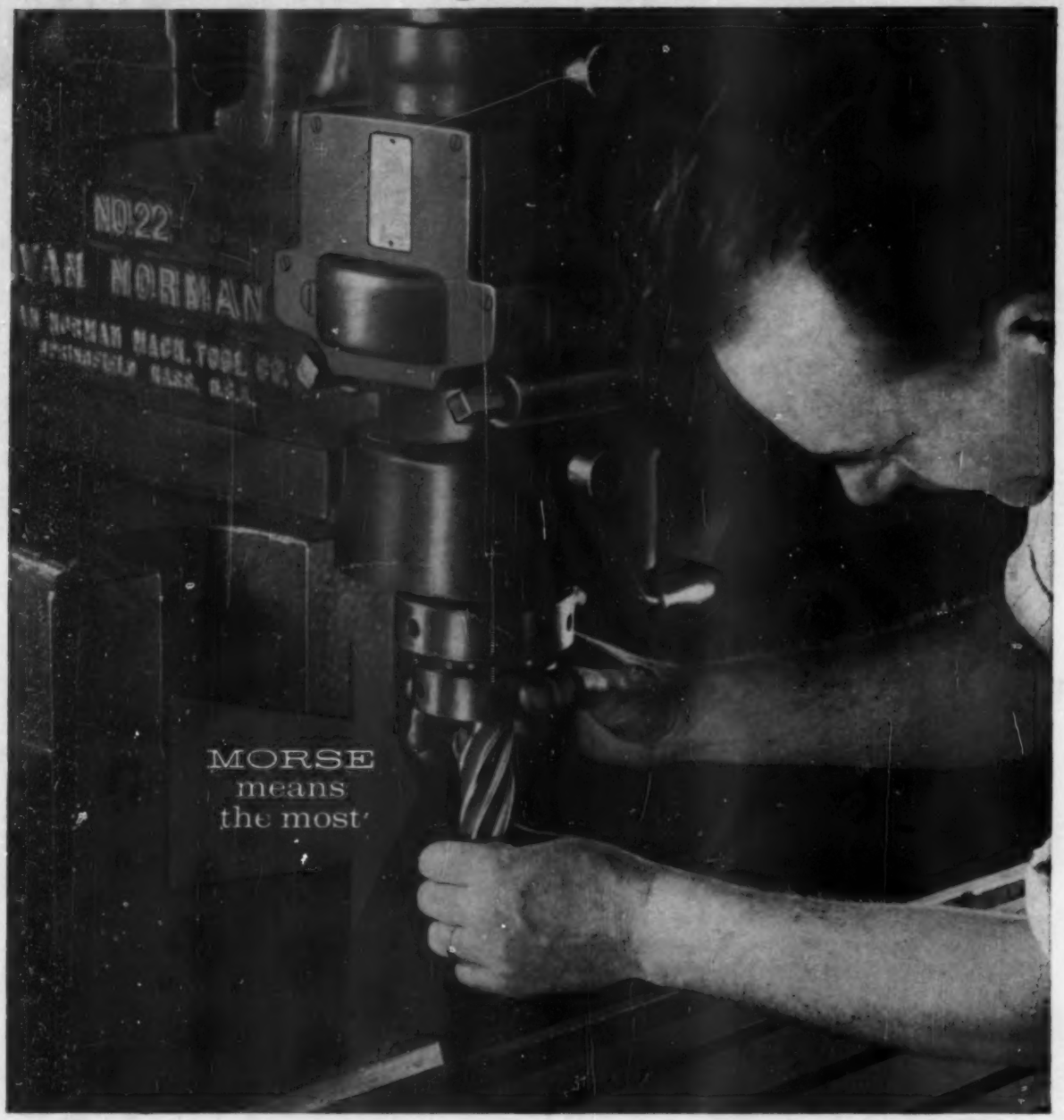

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AIRCRAFT and MISSILES...

TRENDS

Industry outlook . . .

Aerospace Industries Association forecasts 1961 sales of about $11 billion for aircraft and missile producers, about the same as the 1960 rate. The trade association expects that combined military plane and missile expenditures, which make up about 80% of the industry's shipments — will remain the same in the new year as in 1960. But deliveries of planes will continue to drop while missile production rises.

In addition to the anticipated sales increase for missiles and other space vehicles, AIA predicts a "high level" of sales for turbine-powered commercial transport planes, business aircraft, and helicopters.

1960 sales and production . . .

Production of military planes declined from 1700 in 1959 to about 1200 last year. Sales of commercial aircraft, engines, propellers, and parts totaled about $2.2 billion, up $500 million from 1959.

Total commercial aircraft output for the year (including helicopters) amounted to about 8,000, slightly below 1959 production of 8242 planes. About 230 turbine-powered transport planes were delivered in 1960, 30 less than in 1959. Orders for over 258 turbine transport aircraft, valued at about $1.2 billion, were on U S producers' books at the end of October.

Sales and earnings . . .

The twelve major airframe makers racked up a slightly higher sales volume than the $7 billion total recorded in 1959. Three firms, however, reported substantial losses for the year. Average net profit for the other nine companies continued at a level of 2.4% of sales. Earnings of the nine amounted to $105 million, compared to $90.5 million for 1959.

Backlog situation . . .

The industry's steady decline in order backlogs was halted in the July-September quarter last year. On Sept 30, 1960, aircraft-missile producers showed an order backlog of $12.5 billion, up $400 million from Dec 31, 1959. The military backlog for products other than aircraft accounted for the increase, to offset the continued drop in military aircraft contracts.

The commercial backlog declined slightly during 1960 as deliveries of turbine-powered transports rose. Backlog for piston-powered transport has virtually disappeared.

Aircraft exports rose in 1960 . . .

Exports of both civil and military aircraft equipment rose sharply in 1960. In the first seven months alone, there was an 88.8% increase over the previous year. The increase reversed the export trend during 1956-59.

During the year, 230 gas-turbine-powered transport planes were shipped abroad. This brought total exports to 515 since deliveries began two years ago.

Employment still declining . . .

Industry employment continued to decline last year. The aircraft-missile work force totaled 639,700 in September 1960, the lowest level since 1955. The industry's employment rate is expected to remain at about this level during the early months of the year.

Meantime, average hourly wages continued to rise in the industry, mainly because of the requirement for more highly skilled workers. In September 1960, average hourly wages amounted to $2.73, 11¢ over the 1959 annual average. Weekly wage rates rose about 4%.

Shift to smaller production seen . . .

A forthcoming shift from large to small production volumes will bring substantial changes in the defense business, says John H Richardson, vice president-marketing of Hughes Aircraft Co.

One of the last high-volume defense procurement cycles will end with the final deployment of intermediate range and intercontinental ballistic missiles.

The "new" defense business, says Richardson, has resulted in a buyer's market characterized by "sophistication, small volume, closer management, more cost-consciousness, an indeterminate nature, high risk, and a low return."

The emergence of a Soviet nuclear delivery threat in 1957 has been chiefly responsible for these changes, he says. It necessitated a shift in emphasis to a balanced force concept of defense, in case we didn't recover our strategic superiority. This shift toward a balanced force has enormously increased the number of our weapons requirements.

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MACHINE TOOLS... TRENDS

Builders have high hopes...

Some machine tool builders are going into 1961 with high hopes of better business.

Clearing Division of U S Industries Inc is one of them. President John Bartizal says that his company has a substantial backlog, thanks to international operations.

13 large moving-bolster presses for U S customers are included in the backlog. Seven of these presses are for a leading automobile maker.

Another domestic order is for an automobile wheel line for a Detroit company. This line is similar to one shipped to a Coventry, England, firm some time ago.

Clearing's foreign affiliates, Vickers-Armstrong in England and Innocenti in Italy, are booked solid with press orders for up to 22 months. Clearing's Chicago plant is benefiting from foreign orders. Clearing is now completing at Chicago five presses for a Japanese user. Two large moving-bolster presses are on order from an Italian automobile maker.

Clearing ascribes much of its high volume of overseas sales to ability to arrange long-term financing through the Export-Import Bank and other sources. Clearing is processing a large number of inquiries, both domestic and foreign. It is confident that a good share will be converted into orders.

A prominent builder of cutting-type machine tools is going into 1961 with a five-and-a-half months' backlog. It is handling enough inquiries that it feels that the first quarter should be good. Its orders in the final 90 days of 1960 made it the best quarter in several years.

N/C machines in demand...

Numerically-controlled machine tools are selling better than anticipated, this builder says.

Another maker of cutting-type tools has a three-months' backlog, or considerably more business than it had a year ago. It is expecting orders in the first quarter to be up materially.

Most of the sales of numerically-controlled machines by one builder have been to private rather than government buyers. This trend is likely to continue.

This builder feels that orders during this year will be principally for upgrading and replacement purposes rather than for new facilities.

December showed a 50% gain in new orders over November, a maker of standard cutting-type machines reports. This company expects January to be better than December and is much more optimistic about 1961 than it was a month ago.

Natco buys new plant...

National Automatic Tool Co, Richmond, Ind, intends to move all its operations into a 365,000 sq ft plant at Richmond formerly occupied by Bucyrus-Erie Co's well drilling equipment division (now at Evansville, Ind). The new plant has about half again as much space as Natco's present factory.

The enlarged facilities will enable Natco to diversify its operations. It is having marked success with its plastics injection molding machines.

Recently it began manufacture of press brakes and honing machines, in addition to its regular line of multiple-spindle boring, drilling and tapping machines and large transfer machines.

Natco expects to announce shortly its entry into production of other products.

Germans look to US...

U S machine tool builders should get set for stiff competition from at least a few important West European builders. The latter have been so busy the past year or two filling orders round the world that they have been indifferent to the U S market. This is no longer the case.

While orders are still being placed with these European builders at a high rate, there are signs of a slight letdown and a rounding off of volume from its dizzy peak. So these builders are getting ready to solicit orders much more actively than heretofore in this country.

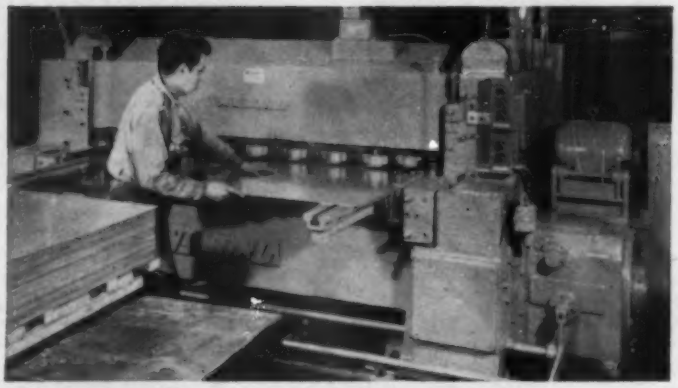
Japanese eye US market...

The Japanese are eying the U S market too. Hitachi Precision Machinery Industry Co has formed a trading division, Hakko Co Ltd, and has sent a permanent representative to Los Angeles. Hakko expects to become export agent for Japanese machine tools to this country. Hitachi plans to export 4-A and 5-A turret lathes and milling machines, built to American standards, to American users beginning this spring.

How Ryerson gives you EXTRA VALUE IN SHEET STEEL

Carbon control—Did you know that Ryerson can furnish a conformance report, if requested when your order is placed, certifying that hot or cold rolled low carbon sheets in stock sizes are SAE 1008 with maximum carbon content of .10? This means you can minimize or eliminate problems of variation in formability and weldability.

Closest cutting tolerances—Our standard "aim" tolerances are the closest in the industry. For example, on shearing of sheets: width or length tolerance—under 48", -1/32"; 48" and over, -1/16". These limits can be guaranteed upon specific request, given in advance of processing your order.



Fast, dependable service—Hundreds of customers often cite these two major reasons for ordering from Ryerson: absolute confidence in "dependability of service as promised," and speed of service to meet their most critical requirements.

Whatever your sheet and strip requirements, a Ryerson specialist is ready to consult with you. A phone call is all it takes.

METALOGICS

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MATERIALS...

Metals for tomorrow...

"Introduced from a foreign country; extraneous; foreign." These are the words used in the Merriam-Webster dictionary to describe "exotic." Despite the glamour that goes with the materials being called "exotic," the metals and alloys upon which so much of the hope for success in space travel and in solid-state devices is placed, the unflattering word "extraneous," is the reason for calling these metals exotic.

Metals properly entitled "exotic" were, until recently, considered the non-essential, foreign matter—trace elements—found in the ore bearing more valuable metals. Thus, "exotic" is a misnomer rapidly being confused with "extraordinary." It is becoming, incorrectly, a synonym for "exciting." Today, "unique" might better describe these metals. *Quixotic* might be even more accurate.

Demands of the atomic and space industries for the rare and exotic metals, in extreme purity, are revolutionizing industry. In order of decreasing melting point, these metals include: tungsten, rhenium, osmium, tantalum, molybdenum, iridium, columbium, ruthenium, hafnium, rhodium, vanadium, and chromium.

Titanium, far from rare in nature, might be considered unique because of the difficulty in extracting it from its ore. Beryllium, too, although its melting point (2345 F) is considerably lower than those of the other metals mentioned, should be in the exotic category. Not all of the exotic metals are characterized by high melting points. Some, such as bismuth, indium, gallium, etc, have unusual electrical or electronic properties or have nuclear energy applications.

Frictional heat will limit speeds of aircraft operating within the atmosphere to about Mach 4. At this velocity, skin temperatures will approach 2000 F. During the brief periods of reentry, gliders and missiles will exceed temperatures of 10,000 F. Materials must be developed to withstand these temperatures and the forces at these speeds. The high-melting point metals, or their alloys, plus certain stainless steels and superalloys, are essential to further aeropace progress.

Thermionic generators operate most efficiently at high temperatures. The next decade will see substantial growth in this method of producing electrical energy. But the horizon is clouded by the lack of materials to survive 3000 F under load. And even higher temperatures are desirable. Fuel cells, too, will require these special metals.

High-yield-strength (to 350,000 psi) will be available primarily in sheet and bar form. As higher temperatures are required to process refractory metal alloys, high vacuum, high temperature furnaces will be required in increasing numbers for heat treating high-melting-point, atmosphere sensitive materials. Much development still is necessary in this area.

Manufacturing equipment, too, must be devised to work these tough, high-temperature materials. Facilities such as the Infab project, with machine tools in an argon-filled room, will be needed to work metals such as molybdenum.

Supplies are limited...

One factor in the use of exotic metals cannot be ignored: They are in extremely short supply and they are costly. Where possible, these metals should be used as protective coating or cladding, or as alloying elements. An urgent need is for improved ferrous and superalloys, perhaps containing the refractory metals, to withstand the high temperatures and forces, yet be available in commercial quantities.

Consideration of H-11 and other hot-work tool steels for these high-temperature-strength tasks is a natural. Tensile strengths of 260 to 300,000 psi at high tempering temperatures and adequate ductility are practical. Up to 1200 F, some of these steels have the highest strength/weight ratios of any commercial structural metals. Recent improvements, expected to advance even further, in H-11 type alloys provide strengths above 300,000 psi.

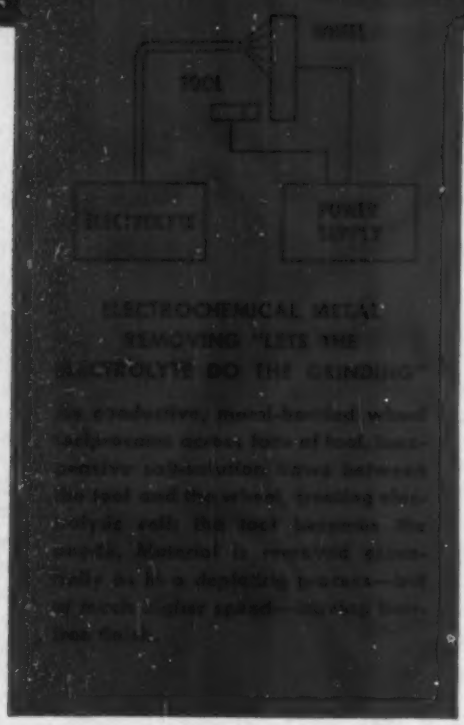
And low temperature operation is a problem too. In this area, for liquified gases, rocket fuels, and operations in the polar regions, the nickel-alloy steels and some aluminum alloys seem to offer the best hope of success. For the short range outlook, these cryogenic developments seem to hold more commercial possibilities than the high-temperature projects.

In the years ahead the metallurgist must receive greater recognition as a scientist, or as a "materials engineer." He must understand physical chemistry and have a better knowledge of manufacturing processes and environmental conditions than ever before. Materials are the key, or the obstacle, to achieving our technological ambitions. If budgets are increased for aerospace research, a substantial portion of the expenditure will go into materials development. Whole new areas of knowledge can be expected to unfold.—**William M. Stocker, Jr.**

NEW

Reciprocating Electrolytic Tool Grinder

MICRO-FINISHES CARBIDES, CUTS DIAMOND-WHEEL WEAR 80%



59-25

Because its reciprocating wheel just "wipes away" the carbide particles, Ex-Cell-O's Style 264 Electrolytic Tool Grinder reduces diamond wheel consumption by as much as 80 per cent! With one set-up, tools can be precision-finished to better than 15 micro-inches—free from heat checks, cracks or burns caused by abrasive contact.

The Style 264 grinds the cutting edges of carbides and other super-hard tool materials at one end, grinds chip breakers at the other. Wheel stroke is fully adjustable. Standard equipment includes: Ex-Cell-O Precision Spindle with inbuilt reversible motor, universal chip breaker fixture (shown in circled inset, above), and pressure system for electrolyte.

Write direct, or see your Ex-Cell-O Representative for details on the Style 264, conventional Style 142 Reciprocating Tool Grinder, and others in the complete Ex-Cell-O line.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

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Machinery Division

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CIRCLE 199 READER SERVICE CARD

WHAT'S AHEAD... in Metalworking

TRENDS

No immediate upturn seen . . .

The metalworking industry anticipates a slight pickup in business activity after the usual seasonal decline around the holidays, but there is little expectation of any significant upturn before the second quarter of 1961.

Steel producers report that incoming orders are running ahead of a month ago, and observers expect production in January will climb back to the levels set during late summer and early autumn.

Automotive buying of steel has been good, and is expected to continue. But the appliance makers are still holding back, say the steelmakers.

Demand for farm equipment is on the rise and industry sales in 1961 should be 15% higher than in 1960. Excessive inventories appear now to have been worked off, and production in line with sales can be resumed.

Metalworking job shops closed out the year about 5% higher than 1959. "We're glad to have the year end this way. For a while it looked as if we were going to fall below 1959," said one spokesman.

Cutting tool manufacturers report that tooling for tape-controlled machines is in great demand. Demand from the automobile industry is strong, while that from the aircraft and farm equipment industries has weakened over the year. Backlog of cutting tools is up 10-15% from last year. Business in the last quarter was up about 12% from the corresponding period in 1959.

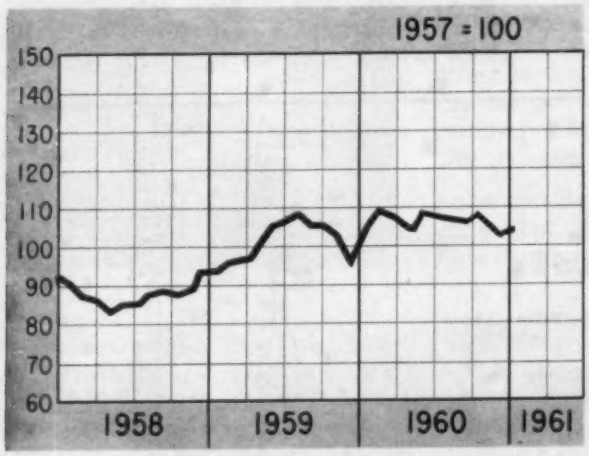
The Industrial Heating Equipment Association's latest report shows a decline of 23% in net new orders for the latest month. For the 11-month period January through November 1960 net new orders totaled $74,197,000, down 21% from the same period in 1959.

Small electric motor production and sales continue slightly under 1959 levels. In the integral and fractional-hp motors, unit volume is off and sales, in general, have not been up to expectations. General softness in the appliance industry is given as one reason for the slump.

Auto parts producers are operating at the same slow pace as in the past two months. Recent cutbacks in auto production plus a heavy inventory of 1961 models have caused a lag in parts ordering. But the outlook is for good acceptance of the new models and this will mean a good year for parts makers.

Prospects for the contract tool and die industry are clouded by the widespread policy on the part of mass-production manufacturers to delay orders for tooling until the last moment. The addition of "precision machining" to the industry association's name would seem to indicate where the future lies for the tool and die manufacturer. Shipments in 1960 should be about 10% higher than in 1959, mainly because of large automotive tooling programs early in the year. This would bring shipments almost back to the total for 1957, a good year, but still well below the peak reached in 1956.

Production of industrial fasteners continues at slightly reduced levels, in the same relation as sales and production of the consumer durables on which the fastener industry depends heavily.



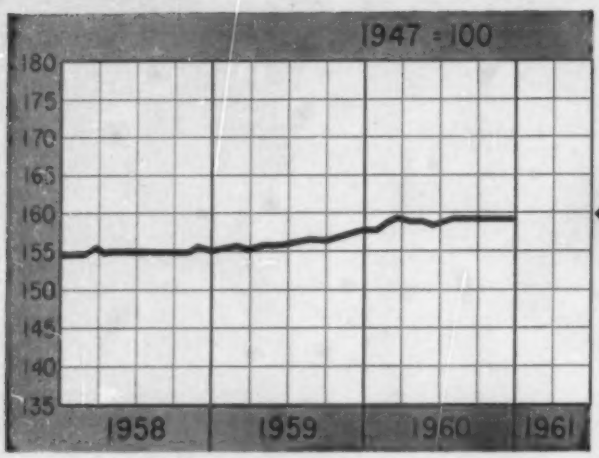
AMERICAN MACHINIST INDEX OF METALWORKING PRICES

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

102

	DEC Estimated	NOV Preliminary	OCT Revised	NOV Year Ago
Total Index	**102**	**101**	**104**	**95**
Machinery	**98**	**100**	**103**	
Electrical Machinery	**107**	**107**	**108**	
Autos	**104**	**119**	**62**	
Other Transportation	**91**	**90**	**91**	
Other Metalworking	**106**	**109**	**101**	

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	DEC Estimated	NOV Preliminary	OCT Revised	NOV Year Ago
Total Index	**159.5**	**159.5**	**159.4**	**159.5**
Metalworking Machinery	**193.3**	**193.3**		**188.8**
Other Machinery exc. Electrical	**173.1**	**173.3**		**171.9**
Electrical Machinery	**158.7**	**158.7**		**162.4**
Fabricated Metal Products	**147.6**	**147.4**		**148.2**

A brief dip for early '61 . . .

Business activity in the first quarter of 1961 will not measure up to the pace of 1960's final three months. But it will not fall far short of the mark. As measured by the gross national product, total business volume for the first quarter will be about $502 billion, on an annual rate basis. That's just a shade under the $504-billion rate estimated for the final quarter of 1960. The dip will be brought on by a fairly sizeable cut in private investment, while spending in other sectors of the economy rises.

Government spending will increase by $1.5 billion to a yearly rate of $103.6 billion in the quarter. Federal outlays will hit a $54-billion annual rate. State and local government expenditures will rise to a rate just under $50 billion.

Consumer spending will remain the key sustaining force in the economy. It will not, however, improve significantly in the three months ahead. Outlays for consumer goods and services in the current quarter will rise to $330 billion, a $1-billion gain over the rate for the preceding three-month period. Consumers will step up their spending for services (transportation, rent, for example). But they will shave their outlays for durable goods. The absence of significant income gains undoubtedly discouraged some consumer spending late last year, and will continue to do so in the immediate future.

Private investment, meanwhile, will decline in the opening months of 1961. A $2-billion reduction in the rate of producers' durable goods purchases appears likely for the first quarter. More significant, businessmen will cut their inventories substantially. The rate of inventory cutting is likely to reach $4 billion for the quarter, a considerably sharper paring than stocks underwent in the preceding quarter. Because of these cutbacks, gross private investment will slip to an annual rate of $64 billion in the initial quarter of 1961.

WEEKLY BUSINESS INDICATORS

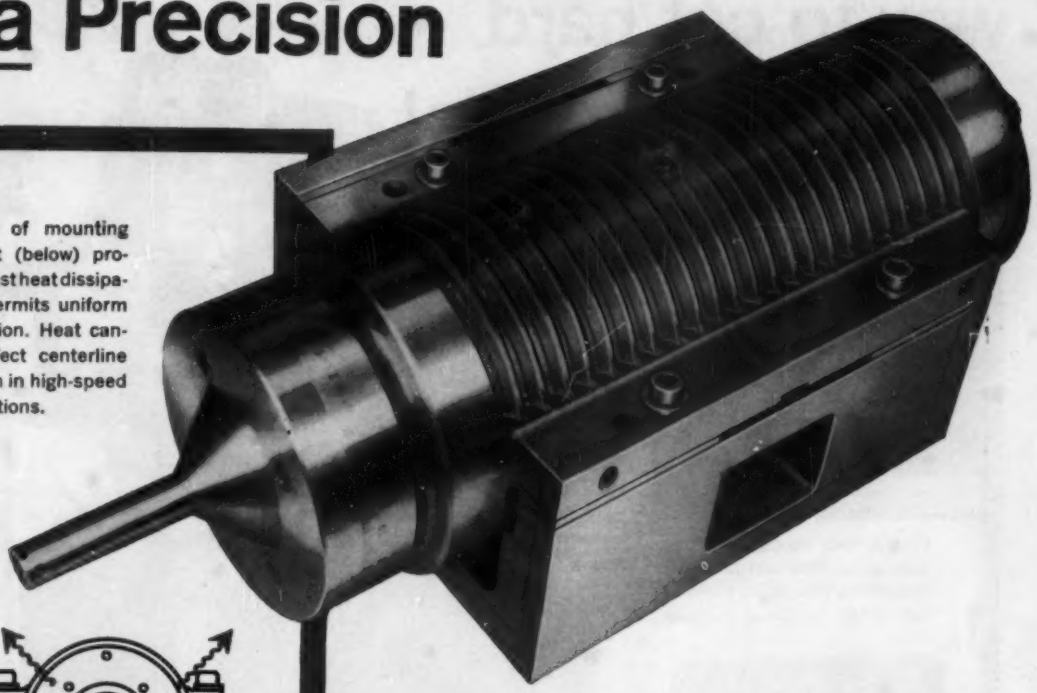
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	144.0	144.9	156.0
Steel ingot operation (thousands of tons)	1,122	1,325	2,726
Electric power output (million Kilowatt hours)	15,021	14,604	14,150
Production of automobiles	113,416	130,711	103,219
Engineering construction awards (Eng. News-Record — Thousands)	67,744	68,517	52,460

MONTHLY BUSINESS INDICATORS

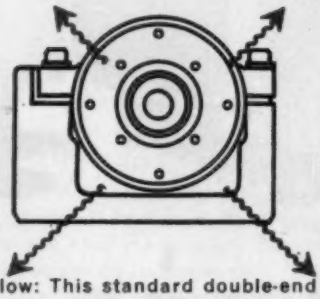
	Latest Month	Preceding Month	Year Ago
Index of industrial production (1957 = 100)*	105	107	103
Index of durable manufactures production (1947-1949 = 100)*	99	101	96
Durable goods manufacturers' sales millions*	14,140	14,400	14,047
Machinery manufacturers' sales, millions*	4,620	4,640	4,666
Durable goods manufacturers' new orders, millions	13,800	14,620	15,099
Machinery manufacturers' new orders, millions	4,460	4,750	4,982
New Orders for Nonelectrical Machinery (1950 = 100)*	162	166	149
New Contracts for Industrial Construction (1950 = 100)*	207	192	154

*Seasonally adjusted

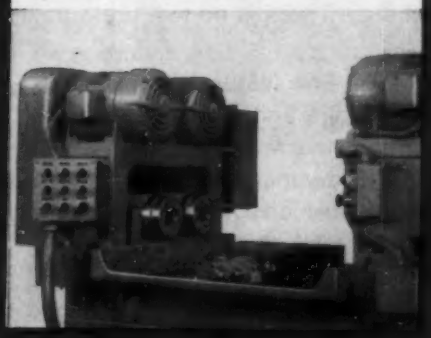
NEW Ex-Cell-O Spindles for Ultra Precision



Design of mounting bracket (below) provides fast heat dissipation, permits uniform expansion. Heat cannot affect centerline position in high-speed applications.



Below: This standard double-end Ex-Cell-O Precision Boring Machine provides a steady platform for the ultra-precision boring job described at right.



The special spindle shown above is one of 16 identical Ex-Cell-O Ultra Precision Boring Spindles recently developed for an extremely demanding boring operation.

Customer specifications called for a guaranteed maximum allowable .00003″ on roundness, with a 10 RMS or better surface finish. The spindles Ex-Cell-O delivered have consistently held .00002″ on roundness, with a 6 micro-inch surface finish (and the customer has ordered duplicates)!

Why do the new Ultra Precision Spindles and other standard and special Ex-Cell-O Boring and Grinding Spindles give consistently greater accuracy, finer finishes and longer, trouble-free life?

The answers are: Engineering and production experience (more than 40 years); exclusive design and construction (using famous Ex-Cell-O Spindle Bearings); and job-tailored availability (Ex-Cell-O offers the most comprehensive line of belt-driven, air-driven, motorized and high-frequency spindles available today).

Need fast delivery of Precision Spindles for original equipment or replacement use? Call your Ex-Cell-O Representative today, or contact Ex-Cell-O in Detroit.

60-85

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LECTRA-FORM...The easy, low-cost way to cut hard and tough metals!

Lectra-Form produces an accurate, inverse image of the tool with a fine, uniform matte-type finish.

This wrench die was machined by Model 244 shown at right. Removable front panel of dielectric tank simplifies loading.

If the material you're working conducts electricity . . . you can drill, tap, pierce, trepan, slot or cut it, or sink intricate die cavities in it with LECTRA-FORM, the all-new Ex-Cell-O Vertical Electrospark Machine!

Using low-cost, conductive sheetmetal or tubing for tooling, LECTRA-FORM produces an inverse image of the tool, or electrode, through high-current, low-voltage electrical spark discharge. There is no tool pressure, no heat.

Standard Model 244 features include four-way slide positioning and vertical knee movement, automatic tool feed and gap distance control, front-load work tank, plus graduated dials for work positioning, a power supply cabinet and dielectric fluid storage tank.

Contact your Ex-Cell-O Representative, or write direct for complete details.

60-79

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American Machinist / Metalworking Manufacturing ESTABLISHED 1877

Why the Squeeze?

The Walsh-Healey Act keeps popping up in the news. The reason is that it is being applied in such a way that the squeeze is put on small business.

Walsh-Healey, passed almost 25 years ago, gives the Secretary of Labor the power to decide the prevailing minimum wage to be paid in industries doing business with the federal government. As the years have gone by, it has been variously interpreted.

In recent years the Labor Department has been on what one critic calls "a Walsh-Healey jag." 51 wage decisions have been made in 46 different industries.

The law clearly states that . . .

any minimum wage established should be based on the local prevailing minimum for similar work. Yet 49 of the 51 wage determinations have been put on an industry-wide basis. The same minimum wage thus applies in Keokuk, Iowa, as in Chicago.

On top of that, the Labor Department has seen fit to calcuate the minimum rate on wages paid to half or more of the employes in half or more of the plants in an industry. This means that the prevailing wage in the larger plants is taken as a criterion.

Even the Small Business Administration has been moved to object to this procedure. It has commented caustically that the way in which Walsh-Healey is being applied tends to raise wages to levels of large firms without regard for local economic conditions and for the financial problems of small businesses.

Its objections are borne out in the experience of a small metal fabricating firm in Georgia. By a Walsh-Healey ruling, Jebco Inc must increase its minimum wage from $1.10 to $1.43 an hour. Because of the higher costs involved, Jebco has had to close its Jonesboro plant, which is in a depressed industrial area, and cut its work force at Warrenton from 100 to 60.

Now the Labor Department . . .

is closing in on the machine tool industry. It would be interesting to know why it picked this industry for minimum wage determination just at a time when machine tool builders are in the midst of a serious recession.

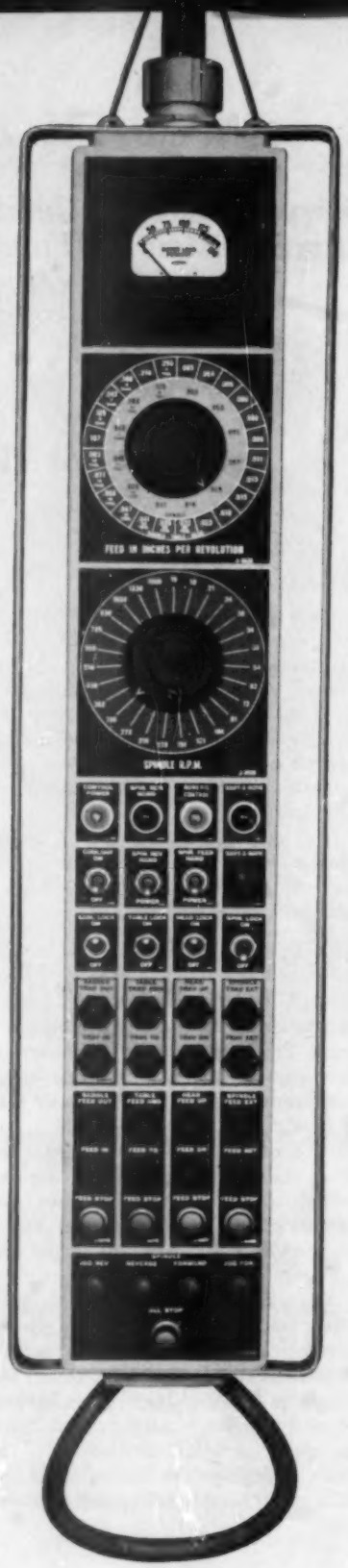
The machine tool industry is Small Business personified. It is not concentrated in any one spot, but is widely scattered in large cities and small towns. It is beset by low-priced foreign competition made possible by low labor costs abroad. The demand for its products has been at low ebb for a long time. By no stretch of the imagination could it be termed "a sweat-shop industry" which pays its employes badly.

The suspicion lurks . . .

under the circumstances that the Labor Department may be doing something for the unions in the machine tool industry, as well as in other industries, that they have not been able to do for themselves at the bargaining table.

By its Walsh-Healey activities recently, the Labor Department has gone far beyond the intent of Congress when it passed legislation in 1936. The time has come when Congress should again take matters into its hands and repair the damage that the over-zealous Labor Department is doing.

Burnham Finney EDITOR



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4. Spindle hardened to full 5/32″ depth; hardened taper.
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12. Pressure or splash lubrication to all running parts.
13. Long narrow guides, screw feeds within guides.
14. Wide selection of column, table and bed sizes.
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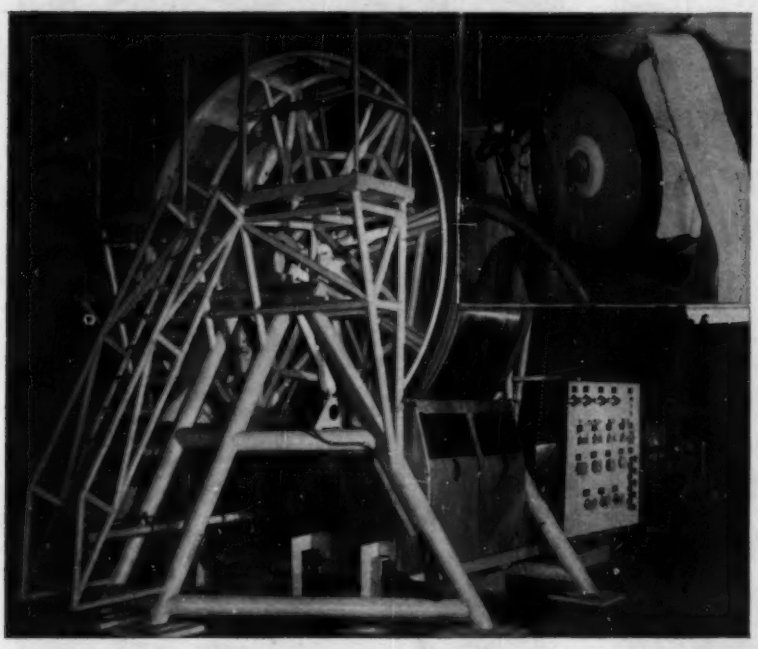


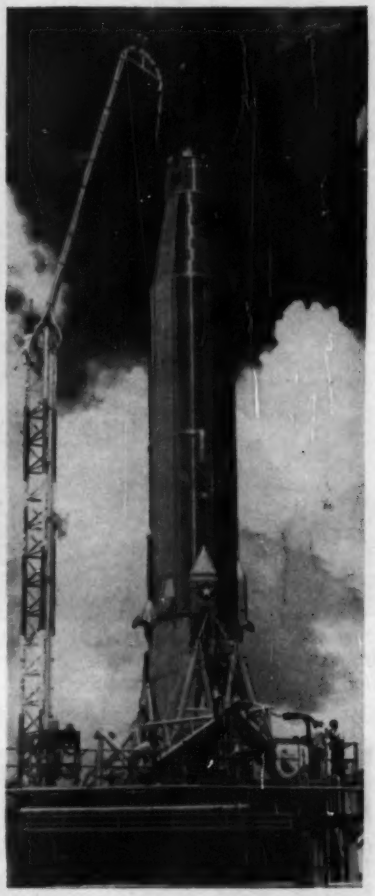


Fig. 1—Ten-foot-diameter drum has missile skin wrapped around it and held securely for trimming. Working platform near top allows operator to observe and perform final trim to give circumferential length. Color inset: Drum rotates past two abrasive cutoff wheels, trimming both edges simultaneously

Tooling up a stainless balloon

By H M Edwards and W P McGregor, tool development engineers
Convair Astronautics Division, General Dynamics Corp, San Diego, Calif

The tank of America's most successful missile, the Atlas, is nothing more than a 10-foot-diameter stainless steel "balloon" with a skin thinner than a dime. This balloon (which is shaped like a blunt pencil rather than a ball) is in effect a giant football: Without pressure, it collapses; with pressure, it will stand a tremendous amount of punishment. It stands to reason that such a unique end product demands unique tooling.

(Atlas assembly procedure was discussed in AM—Jan 1 '60, p71, but here is a more detailed description of tooling for skin assembly).

Take, for instance, the trimming of individual skins (shown in Fig. 1 above) — both edges of the skin, over 30 feet on each side, are trimmed automatically and accurately to prepare for circumferential welding.

With the skin wrapped around a drum and held securely, abrasive cut-off wheels trim the skin as the drum rotates past the wheels. The variable speed of these abrasive wheels is controlled by hydraulic motors. To obtain the correct skin circumference, a moveable abrasive wheel traverses the skin width, trimming it to exact size.

The trimmed skin is then taken from the trim fixture by hand and folded into a padded cart for transporting and handling, remaining in the cart, which is rolled under a weld fixture (see Fig. 2). Each end of the skin is clamped pneumatically along an inert-gas-supplied backup bar (see Fig. 3). The skin is welded into a continuous band by a semi-

Fig. 2—Trimmed skin is taken from fixture manually, loaded into padded cart, and is heliarc buttwelded into a continuous band in this fixture

Fig. 3—Closeup of one-inch-wide, stainless steel multiple clamps (stainless prevents contamination and arc blow) which hold skin during buttwelding. Fire hose actuates clamps

Fig. 4—Heliarc buttwelded skin, now a continuous band and still in the padded cart, which protects as it transports, is roll-planished in this machine

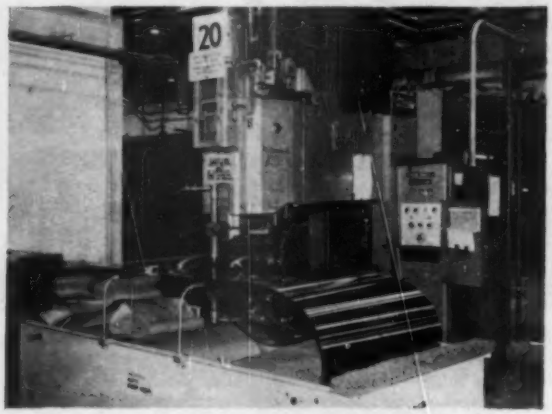


Fig. 5—Reinforced doublers are welded over the heliarc welds by this standard spotwelding machine to provide necessary strength

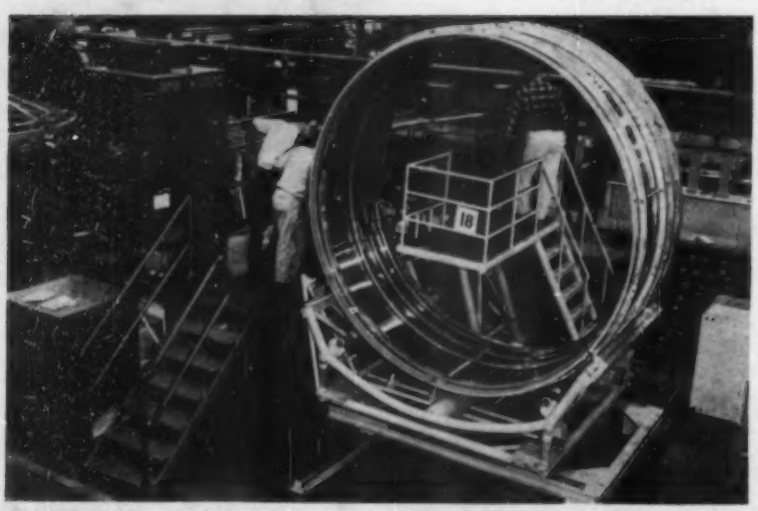


Fig. 6—Two skins, each with internal and external backup rings installed, are seam-welded together in this fixture

automatic, inert-gas, tungsten-arc welding process.

A backup bar swings out so that the skin can be easily removed from the welding fixture. The weld is then roll-planished (Fig. 4) while the skin is still in the cart. This improves the physical properties of the weld through cold working, making the weld as smooth as the parent metal — a great advantage in subsequent seamwelding.

Next, a reinforcing doubler is spot-welded on by a standard machine (Fig. 5). The skin is then removed from the cart and placed on its edge, so arranged as to form a cylinder, and internal pressure rings are installed and semi-inflated to hold themselves in position.

The external backup rings are then positioned, and the internal rings inflated to maximum pressure

Fig. 7—"C" gun in barrel fixture (center) is raised with one skin in place, waiting for second skin to be lowered into position on top

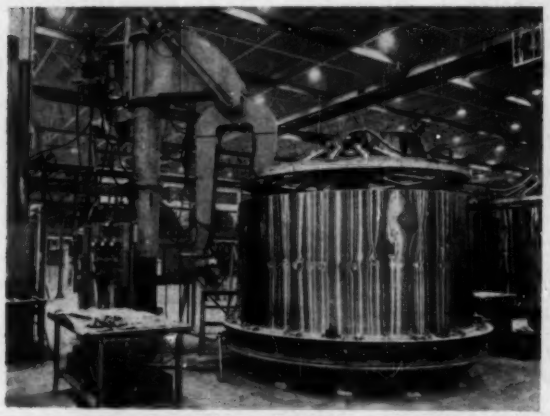


Fig. 8—Fixture with "C" gun lowered into position to weld two skins together. Skins rotate past gun, which moves up and down

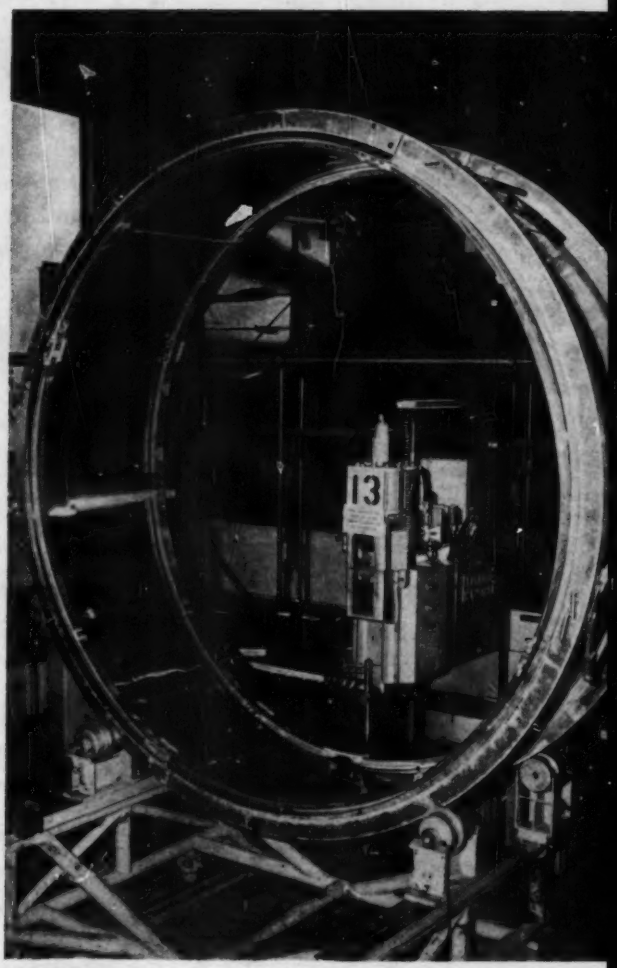


Fig. 9—External bracketry is welded on in this standard spotwelding machine. Skin rotates on external rings with internal rings in position

to hold the skin in a true cylindrical shape. The external rings serve as handling tools and also act as large rollers for rotating the tank for seam and spotwelding.

These rings have a plastic face next to the skin, with sections cut out for bosses and required bracketry. This plastic face, which is about an inch thick, can be changed to meet subsequent missile changes. The rings are made in halves to facilitate positioning and removal.

When the individual skins have been completed, they are welded in pairs (Fig. 6) for subassemblies. The two skins, with the rings in place, are positioned on the weld fixture — "stovepiped" so that a predetermined overlap is established.

The fixture is then rolled into the resistance welding machine, where it is tackwelded securely prior to final seam and roll-spotwelding. When the final weld has been completed, the fixture is removed from the machine and the skins from the fixture. Then the pair of skins is placed in a vertical position, the internal rings removed, and the skin assembly is loaded on a spotwelding fixture, where bracketry is added (Figs. 7 and 8).

Aligning the skin

The X and Y axes of the skin must be aligned to correspond with markings on the "barrel fixture." Leveling jacks insure correct station location for the many tooling accessories that locate the bracketry.

A large, hydraulically operated column (Figs. 7 and 8) lowers a large "C" gun astraddle of the skin assembly. The C gun rotates out of the way as the fixture is loaded or unloaded, then moves on to the column to cover the full length of the skins. The tips are positioned normal to the work to accomplish the welding.

External brackets are positioned and spotwelded as the skin rotates past the C gun on a fixture similar to a giant bearing.

After the skin assembly is finished on the barrel fixture and removed, the external and internal rings are repositioned. The skins are then loaded on the spotweld fixture (Fig. 9) for external bracketry welding — angles, doublers, flanges, intercostals, clips, bosses and other sections as required. This fixture is mounted on tracks, so as to allow for lateral movement into various welding positions. The assembly rotates through a standard spotweld machine, where the required bracketry is welded. •

How to bore a "curved" hole

No longer does boring of an angled hole have to be a hit-or-miss affair (too seldom "hit" and too often "miss") of boring in from two directions and hoping the holes will blend correctly. Here is a way of doing the job in a "single pass through"

By Oliver R Wade,
Tolerance Chart Services Co,
Huntington Station, L I, N Y

Boring in from two directions to create an angled hole is a job that is roughly comparable to building a tunnel under a river. If the caissons don't join exactly, the tunnel is a fiasco. So with angled hole boring: If the bores don't meet exactly, the hole will have at the very least an unwanted jog or step in it, and the piece will be ruined.

But there is a way of boring an angled hole in a "single pass through." It involves piggybacking a Moore rotary table on top of a Pratt & Whitney rotary table, teaming them up with a translation device to change the hole angle at preselected depths as the tool feeds in.

So accurate has this tooling concept proved in the boring of angled holes in waveguides that 50 out of 52 pieces in the first lot passed rigid inspection. Compare that with the high scrap conventional methods!

Eight problems in all

Cursory examination of the wave guide in Fig. 1*, indicated two major production problems. These were: (1) boring the hole to the location accuracies of pivot points *B* and *C*, as defined by rectangular coordinates, and (2) inspecting the bore to determine the actual pivot-point locations in space.

Detailed analysis of the part drawing revealed six additional problems:

1. Discontinuity or "dig-in" of the tools could not exceed 0.0015 in. at pivot points *B* and *C*. This requirement was known to be peculiar to wave-guide components. They depend for proper electronic functioning on prescribed internal smoothness and freedom from gouges, pits or fins. Therefore, the decision on boring method favored "single pass through" from one end, instead of the tricky tooling required to align two angular cuts from opposite ends.

2. A boring bar with insufficient diameter for rigidity might be required, because of the ratio of bore length to diameter and the two bend points. If the boring-bar diameter was reduced to marginal size, it might have proved impossible to meet the required 32 rms finish.

3. Face *E* could not be considered reliable for banking purposes, even though two of three dimensions on the *X*—*X* axis were taken from this reference. The wall thickness was too thin and the diameter too small to give sufficient area for locating purposes, especially when the bore length was considered. To avoid adding angle errors, secondary face *F* was chosen for banking purposes.

4. To maintain close tolerances

*In dimensions involving national security, letters have been substituted for numbers.

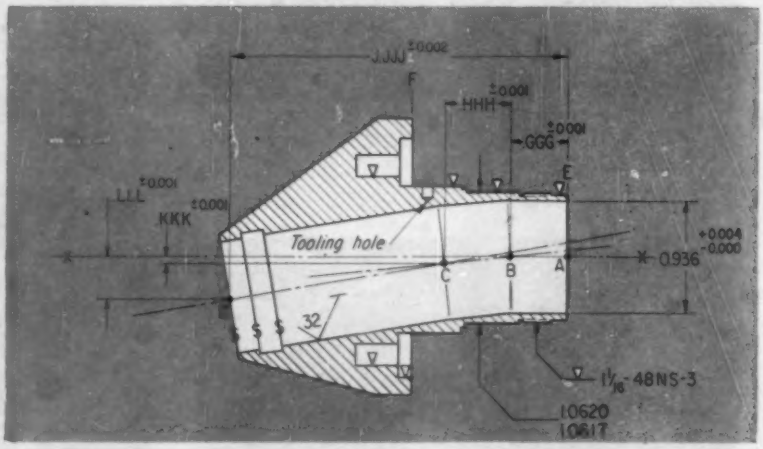


Fig. 1—Cross-section of wave guide shows that hole has two pivot points at *B* and *C*
Notes:
1. Hold *AB* portion of bore concentric to diameters ▽ within 0.001 in. TIR
2. Hold all diameters ▽ within 0.001 in. TIR to each other, including thread
3. Make SSS faces square to bore within 0.001 in. TIR
4. Faces *E* and *F* are held parallel to each other and square to diameters ▽ within 0.001 in. TIR
5. Tool "dig in" at pivot points *B* and *C* must not exceed 0.0015 in.

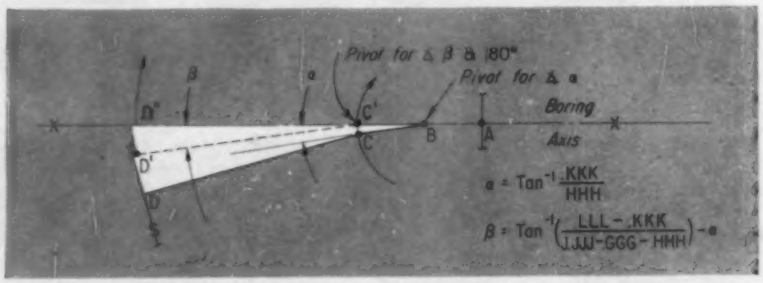


Fig. 2—Schematic diagram of boring problem
Boring procedure:
1. Bore from *A* to *B*, holding concentricity within 0.001 TIR
2. Rotate part through angle *α*. Point *C* goes to *C'* on *X-X*, *D* goes to *D'*
3. Bore from *B* to *C'*
4. Rotate part through angle *β*. Point *D'* goes to *D"* on *X-X*
5. Bore from *C'* to *D"*
6. Rotate part 180° around *C'* to machine face *S*

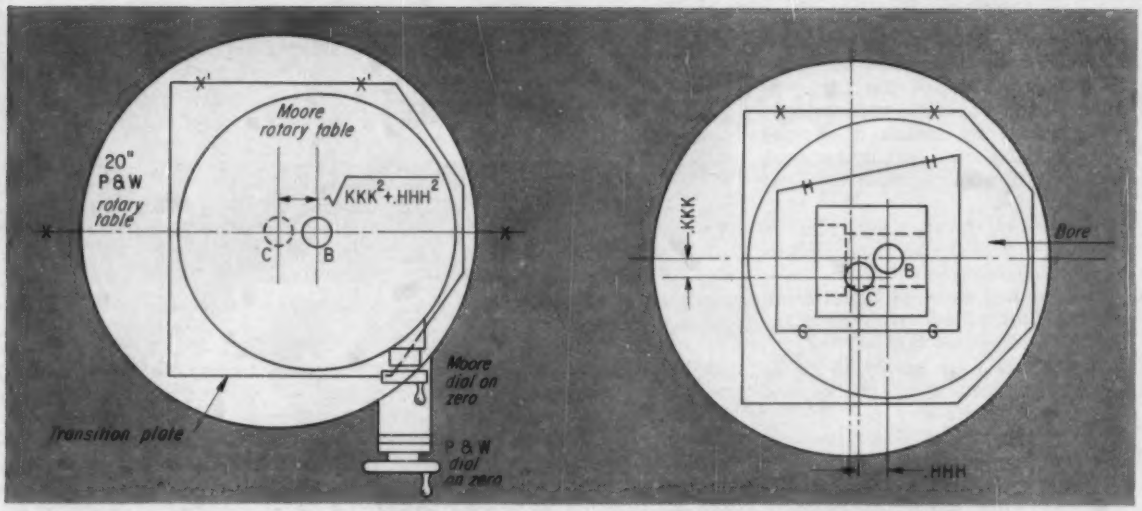


Fig. 3—Setup of two rotary tables and translation plate on Jigmil

Notes:

1. Lapped pin in P & W table picks up honed hole *C* in plate.
2. Backlash out, plate edge *X'-X'* is made parallel to spindle travel
3. Lapped pin through Moore table picks up honed hole *B* in plate
4. Backlash out, all dials on zero.

Fig. 4—Setup of fixture on Moore table

Notes:

1. The pin that aligns the Moore table to the translation plate is used to pick up honed hole in fixture base. Construction hole *B* in top of fixture is in line with hole in base for proof purposes. Hole *B* on centerline of Moore table. Both construction holes *B* and *C* duplicate pivot points in boring
2. Edge *GG* made parallel with *X'-X'* with dials on zero
3. Edge *HH* has same angle as final bore in part (for **setup checkout**)

for runout and squareness, finish boring would have to be done after the thin-walled end was fully machined. The bearing diameter had a limit of 0.0003 in. and the thread was Class 3. Because the material was magnesium, it was prudent from the stress point of view to rough bore the hole and machine the threaded end complete. This decision, plus the change in banking from *E* to *F*, made use of a tolerance chart mandatory. This device insured proper stock removals and control of tolerance buildups.

5. All angles were true in only one plane. Therefore, it was essential that no concealed compound angles be introduced to cause confusion in inspection result. This point was important when designing, building and inspecting locating methods and machine setups.

6. Tooling and methods had to be simple, inexpensive and accurate because the production order called for 50 pieces, with the possibility of a re-order for 200 more. Wherever possible, it was essential to depend on competent machinists to make setups and exercise special care in machining.

A schematic sketch of the boring problem (Fig. 2) was made in conjunction with the above analysis. The sketch and analysis led to these conclusions about the ideal method for boring and choice of machine and tooling:

- Rotate the boring bar and feed into the stationary part as far as pivot point *B*.
- Dwell while the part was rotated through angle α, as determined by the coordinates .KKK and .HHH. In others words, $\alpha = \tan^{-1} \frac{.KKK}{.HHH}$
- Advance tool a distance equal to the hypotenuse of the above coordinates, thus reaching pivot point *C*
- Repeat step 2, but rotate through the difference of the angles established by the coordinates J.JJJ — [.HHH + .GGG] and .LLL — .KKK and α. In other words, $\beta = \tan^{-1} \frac{.LLL - .KKK}{J.JJJ - [.GGG + .HHH]} - \alpha$
- Eject boring bar to avoid scoring the bore. Rotate part 180° to last portion of bored hole. Spot face to fix the .LLL and J.JJJ coordinates and cut groove in bore.

Choice of machine

With the basic machining scheme established, the choice of machine tools was restricted to an engine lathe, jig borer, precision boring machine or a DeVlieg Jigmil. Tooling would vary in complexity and cost, according to machine chosen.

From rough sketches of tooling required by the several types of machines (when boring in horizontal or vertical planes) it was decided that the Jigmil would handle the job economically.

As shown in Figs. 3 and 4, the cuts were made in the horizontal plane by piggybacked rotary tables and a translation plate. The translation plate effected an accurate eccentric offset of the table centers equal to the hypotenuse of the right triangle formed by the pivot-point coordinates *B* and *C*. In addition, the surfaces of the tables would rotate in a plane parallel to the machines' boring axis.

Use of rotary tables

The work fixture was positioned on the upper rotary table, (the Moore), in a specific manner. When the boring tool reached the pivot point *B*, the true cylindrical cutting action of the tool was directly above the center of rotation of the table. At this point, Steps 2 and 3 of the boring sequence could be completed.

When the tool had bored to pivot point *C*, the bottom table (the Pratt & Whitney) could be rotated through the proper angle and boring continued. After boring through, Step 5 could be performed.

Prior to building the translation plate and boring fixture, the two tables were checked for composite parallelism. Separately, each table was parallel within 0.0002 in. in 12

in.; when combined, the parallelism totaled only 0.0001 in. in 12 in.

Before tool design was started, a 10:1 enlargement of the part was made to check about 25 trigonometric calculations. By means of moving overlays, the same layout was used to verify the maximum diameter of the boring bar.

Rough boring left 0.010 in. stock for finishing to the 32 Rms requirement. Roughing and finishing bars, of course, had their individual depth settings controlled by the rotary drum stop unit on the DeVlieg. All tool settings were preset by hardened and ground setting devices built into the fixture.

As shown in Fig. 5, the boring-tool point radius was measured on a comparator before use to determine allowance to be made on depth settings. This allowance compensated for length differences due to tool setting for depth and effective cylinder tool cutting action.

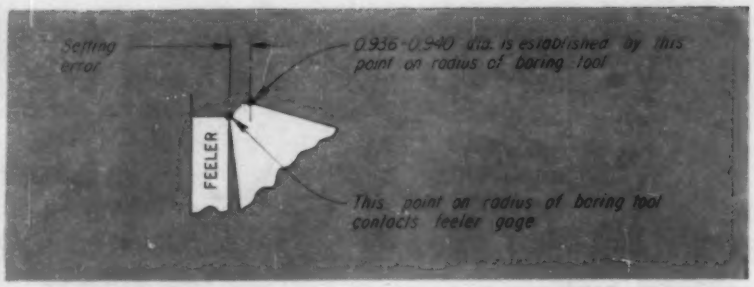
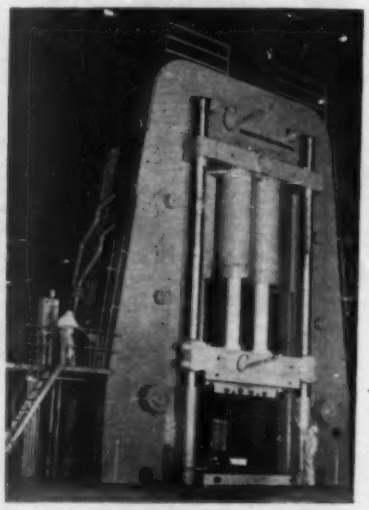

Setting error
0.936-0.940 dia. is established by this point on radius of boring tool
FEELER
This point on radius of boring tool contacts feeler gage

Fig. 5—Check on setting error (depth) due to nose radius on boring tool. Allowance was made on Jigmil stops

Bore inspection was done on an optical comparator, for which an internal contour tracing mechanism was designed by a vendor. Cost of this inspection equipment exceeded all other tooling costs combined, but proved conclusively that critical pivot-point boring conditions were being met. Actual "dig-in" measured about 0.0005 in. at the pivot points.

The job was released in one lot of 52 pieces—and 50 pieces passed inspection. •

Cameron Iron extends closed-die forging



First forging—Billet of A286 stainless is formed into a funnel 12½ ft long. The 12-in. dia stem is backward extruded through opening in ram and an 8-in. hole is pierced. Part will become an aircraft shaft. When side rams are added to press, the Houston firm will make much larger split-die forgings than previously

Jet-atomic forgings in sizes, shapes and lengths hitherto considered impossible to make in one operation will be produced on Cameron Iron Works' 20,000 - ton multiple - ram forging press. In a crash program of less than 6 mos, the firm designed and installed a 3,000,000-lb, 50-ft high machine especially designed to work high-alloy steels, stainless steels, refractory metals and exotic metals in closed dies.

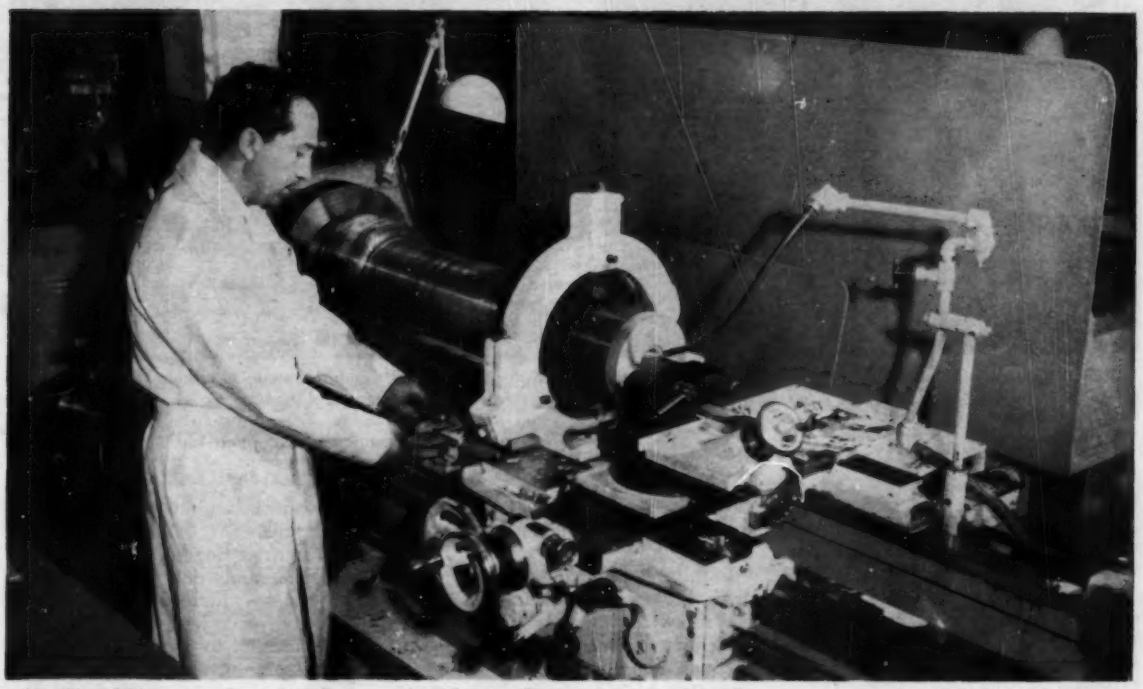
Maximum forging weight is 30,000 lb. Extrusions up to 56 in. dia by 30 ft long (within the forging weight limit) can be made by dropping the main piercing ram assembly. This leaves a 56-in. hole in the main bolsters, the moving platen and the top platen.

Dies for the press will weigh up to 200,000 lb. Daylight is 15 ft, stroke 90 in., platen area 12 x 12 ft. Special throttling control permits speeds of 0 to 400 fpm. When two side rams are installed, side piercing or forming elements in split dies will exert 5000 tons each on the confined metal. In addition, the piercing ram inside the main ram can exert 4200 tons.

The Cameron machine is reputed to be the largest privately owned closed-die forging press and the fifth largest in the free world. Other, larger presses are owned by the U S Air Force and were designed primarily to forge aluminum and magnesium. Cameron will use advanced forging techniques with the press. •

Douglas does it — achieves 0.0002-in. tolerances in . . .

Contour machining beryllium



A beryllium billet is rough machined at Douglas-El Segundo within ¼ inch of finished dimensions on an Axelson lathe in preparation for contour turning and boring. This is one of two throat nozzles for a Mach 10 wind tunnel

High surface finishes and "tenth" tolerances were musts in making throat nozzles for a Mach 10 wind tunnel. The metal: hard-to-work, hard-to-handle beryllium. Here is how Douglas-El Segundo met these tough specs in turning, gun drilling, and boring

Beryllium, that much talked about and much cussed at supermetal, has managed to rack up some fairly impressive entries on the debit side of the ledger—it's expensive, it's tough to machine, and beryllium dust is highly toxic.

But on the credit side, beryllium has high heat transfer and strength-to-temperature characteristics. And that is why it was chosen for two critical throat nozzles for a Mach 10 wind tunnel to be installed at Douglas Aircraft's Aerophysics Lab.

To Douglas's El Segundo, Calif, shop fell the job of machining the nozzles to accurate dimensions.

As delivered, the solid beryllium billets were about 35 inches long, tapering from 9 inches OD at the large end to 6⅞ inches. Rough turning the OD and ID within ¼ inch on an Axelson lathe prepared each billet for all subsequent operations, to be performed on an 18-in. Monarch.

The billets were then annealed to dead soft condition, and aged so as to avoid distortion.

Rough turning

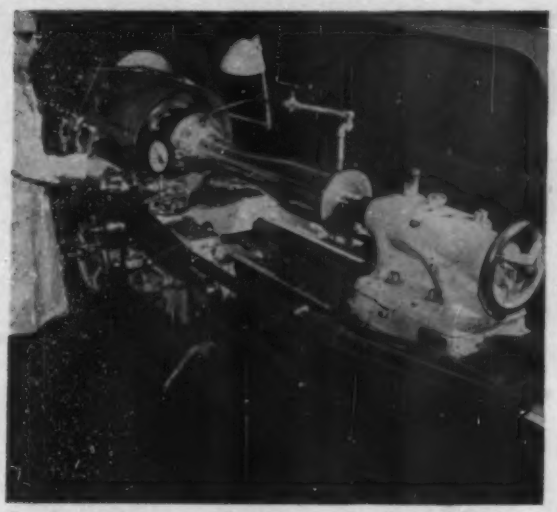
First operation on the Monarch lathe involved rough turning the external contour, using a tracer attachment and templet made of Chromite wear plate — with the stylus surface protected from wear by a 0.001-in.-thick stainless steel foil attached with adhesive bond. (This eliminated hardening the stylus, with the attendant risk of distorting it). The foil was removed for finishing cuts.

Allowances also had to be made for sag (0.004 in.) when the billet was mounted between centers.

In contour turning the OD, surface finish was not critical, was held to about 63 micro-inches rms. Tolerances on the OD were also fairly liberal—about 0.005 inches for most dimensions.

Internal finishes and radial dimensions, however, were precise. Radial offsets were maintained within 0.0002 inches and were checked with precision gage blocks. Lateral inside dimensions produced in boring were checked with Pratt & Whitney standards with "tenth" indicators and with an electronic pick-

Contour machining beryllium...



Rough contour turning the OD of a beryllium billet is the first operation on this 18-in. Monarch lathe. Only routine care and health precautions were necessary in machining this toxic material

Gun drilling the counterbored beryllium billet requires careful selection of carbide bits so as to avoid chatter and poor surface finish. Tolerances are not critical in this operation, which prepares for contour boring

up mounted on the lathe ways.

After the OD was contour turned, the billet was counterbored to provide a starting hole for step gun drilling, which was done not so much for accuracy as to provide a straight, true ID, and to facilitate the precision contour boring that followed.

A detachable-head National gun drill, running at 400 to 450 rpm with 0.001-ipr finishing feeds, was used. Coolant was supplied through a high-pressure pump system operating at 125 psi.

Throwaway triangular carbide inserts with negative rake geometry were used with the gun drill. Here, critical inspection was necessary, because new toolbits, although perfect to the eye, continually produced chatter and poor surface finish.

Crater-free toolbits

Under a 100-power microscope, a surprisingly large number of new toolbits were found to have craters and though they were acceptable for most work, could not be used in this application. By discarding these and using only those bits that passed microscopic examination, the required surface finish was achieved without difficulty.

Maximum strength and rigidity were required in the boring bar in contour boring, which was also done with carefully selected carbide toolbits. A bar shaped to the same contour as that required in the hole was used, along with a precise templet. To produce the necessary surface finish (12 micro-inches rms), high speeds and fine feeds were required.

Infinitely variable feeds were achieved by disconnecting the lathe leadscrew at the gear box end and attaching a variable-drive motor through a chain drive at the opposite end. Roughing feeds ran about 0.010 ipr: finishing feeds at 0.001 ipr. Average spindle speed was 375 rpm. Final passes with 600 grit abrasive paper finished the throat surface to the required degree.

Specifications on completed Mach 10 nozzles call for 0.960-in. ID at the throat end, with the wall tapering from 0.200 in. (at the throat end) up to 0.625 in. at the opposite end of the nozzle. About 80% of the original weight of the billet was removed in machining. •

Crack tests for missile steels

A tiny crack in the rocket case of a fired missile can open up into a split large enough to cause failure or a major malfunction of the missile. Pressure tests made on the case prior to firing often open these minute cracks in the same way. Often, but not always.

A missile case may pass its pressure test yet still have a potentially dangerous crack. The test may have enlarged the crack almost, but not quite, to the splitting point. Upon application of further pressure the crack may split wide open—possibly in flight. The problem is to find out how much pressure it would take to enlarge a crack of a specified size or cause the crack to split open.

Stanford Research Institute, under a contract from Aerojet-General, has devised a technique for producing a standard, "natural" crack, a crack that can be reproduced and be mathematically analyzed.

After several approaches had been tried, the SRI team hit upon the idea of spark machining a thin slot into the metal, cooling the metal to make it more brittle, then driving a powder-actuated steel stud into the slot to produce the crack.

The work was subbed out to a local machine shop. Here, slots of various sizes (0.004 in. wide, 0.003 to 0.030 in. deep, about 1 in. long) were produced in ¼ in. thick-high-strength steel, using a Japax spark-machining unit with a tantalum ribbon electrode.

Slotted specimens were then immersed in liquid nitrogen until boiling stopped, indicating that the metal had reached the temperature of the liquid nitrogen, –196 C. Removed from the nitrogen, the specimen was placed slotted side down, and a steel stud was fired into it directly behind the slot, using a standard Ramset stud gun. •

Safety's sacred cows

A few of them: Management's tendency to read comparative statistics through rose-colored glasses, failure to recognize *all* costs resulting from an accident, assignment of safety responsibility to staff personnel rather than line management and, worst of all, an inclination to regard employees as lacking in instincts of self-preservation

By John B Coyle,
Labor & Industrial Center, Michigan State University

Much of today's safety psychology is more illusion than fact. This can be said, too, of safety statistics, of safety cost accounting, and of cherished concepts of who's responsible for keeping accidents down in a company.

Take for example that darling of plant management, the safety poster. Here, the worker is almost invariably pictured as one indifferent to danger —a man given to dropping wrenches on his fellow workers, to catching ragged sleeves in machines, to tooling a fork truck through a crowded plant like a hot rodder.

Nothing could be farther from the truth, more in conflict with basic human nature. A man does not divest himself of his natural interest in self preservation when he reports for work. As a matter of fact, he isn't humanly capable of indifference, and no company can be as interested in his safety as he is. If he takes a safety risk it is because he is unaware of the dangers or penalties involved.

A man who fully appreciates the consequences of an unsafe act simply does not take the risk. His whole nature is against such gambles.

Figures don't lie?

And let's look at another of industry's pet illusions—the safety statistic. Too often, companies find solace in accident frequency and severity rates that compare favorably with those of other employers generally or in their own industry.

Certainly, these are acceptable barometers of how well one employer's accident rate compares with another's, but are they a realistic index of what any employer's rate *should* be? Why is it, then, that the same executives who view most statistical averages in other business areas with a jaundiced eye get an unwarranted sense of satisfaction out of comparative safety statistics?

The quarrel here is not with the statistics themselves, but with their interpretation. There is no reason why a chemical firm should be complacement because its accident rates compare favorably with those of the steel or textile industry. Much better if the chemical firm would compare its plant, equipment, and safety devices with those of others in its own field. If it is newer and better, the employer deserves to expect, and should insist on, a better accident rate.

Awards, awards

The National Safety Council offers a plaque to any company that can work so many hours without a lost time accident—and it doesn't matter whether it's a watch factory or a steel mill. The idea is excellent, and it does promote safety, but an award to one industry may be substantially more significant than an award to another.

Under the American Standard (recommended by the National Safety Council), only accidents resulting in a full day's lost time are counted. Even some hernias don't come under this criterion.

Carrying this idea to its ultimate conclusion: Accidents of less than a day's lost time don't mean a thing because they don't show up in the statistical standards.

But the accidents of less than a day's severity are just the ones an employer *should* worry about. Most minor accidents are at least potential time losers. If there is anything to preventive safety measures, here is the area of golden opportunity.

Let us also turn the spotlight on safety cost accounting, which frequently gives a great deal of satisfaction to management—most of it illusory. For instance, is the repair of damaged equipment and tools included? The replacement of an injured worker? The processing of compensation claims? Idled production machines? No.

While there may be good reasons for this, it is a fact that accounting systems in effect in most companies are just not geared to costing the real expense of accidents.

Now, look at the job description of a staff safety director: It usually says, "Charged with the responsibility for safety." How can this be?

The responsibility for safety can only rest with the line manager—and any other assignment of such responsibility is unnatural, because efficiency of operation (a line responsibility) and safety are inseparable.

Certainly, staff members can be made responsible for promoting safety, training, investigations, reports, and recommendations. But until the safety staff has the authority to discipline line managers, the full responsibility for safety, or the lack of it, must rest upon line management.

Accordingly, no employer who is completely realistic about safety can explain away accidents by arguing that people are indifferent or irresponsible where their own safety is concerned. This is *really* bad psychology—safety cannot be geared to statistical comparisons. They are irrelevant.

Hidden costs which do not appear in accounting journals cannot be overlooked. They exist.

Line management cannot abdicate its responsibility for safety by delegating the job to staff personnel. This is utterly unnatural unless authority is delegated, too.

Four cardinal principles

To sum up: a realistic attitude toward industrial safety must embrace four cardinal principles—(1) the full cost of accidents must be calculated, (2) a safety program must be dedicated toward the *lowest possible* accident rate, rather than a comparatively favorable one, (3) undivided responsibility for safety must rest squarely on the shoulders of line executives, and most important (4) *human instinct for safety must be recognized as the greatest possible bulwark against accidents.* •

Better wear, improved grain structure

Heading with high vanadium dies

By Robert S Holder, technical staff, Latrobe Steel Co, Latrobe, Pa

Vanadium has been added to the basic 0.90-carbon, water-hardening tool steel used for cold-heading dies. Results: increased wear resistance, and stabilized fine grain over the normal hardening range

It isn't often that a new tool material can invade an established industry. Yet fastener manufacturers, long accustomed to 0.90% water hardening tool steel, are finding that a 3½% vanadium tool steel may show a production advantage of up to 5-1 for cold heading dies.

For a number of years, steels with high vanadium contents have been used in long-run cold-forming applications, as well as for high-speed-steel cutting tools.

Tool-steel selection

Why, then, has it not been until recently that this same metallurgical approach was deemed applicable to cold heading dies? The explanation is simple. Fastener manufacturers select tool steel for metallurgical *and* cost considerations. In the past they have preferred solid dies of water hardening carbon steel 90% of the time, and would use more-highly-alloyed, more-costly-to-build tools which require inserting only for the most difficult jobs.

Until the recent advent of high-vanadium water-hardening tool steel, the straight carbon types had an exclusive metallurgical advantage to the cold heading shop. These steels would harden with a characteristic case-to-core relationship, but the more highly alloyed steels would not.

Success or failure of a die in resisting shock and abrasion depends upon having the proper balance of case depth and hardness. If the case is too thin, the die sinks and cracks at the bottom of the impression, or at the shoulders.

On the other hand, if the case is too deep, insufficient core backing may allow gross cracking or splitting. The hardness of the case provides the abrasion resistance.

Latrobe Steel's new 3½%-vanadium tool steel not only has this desirable case-core feature, but shows improved wear resistance, and no tendency to grain coarsening.

"Hedervan" has a nominal chemistry of: carbon 1.40, silicon 0.35, manganese 0.40, vanadium 3.50, chromium max. 0.15, molybdenum max. 0.10.

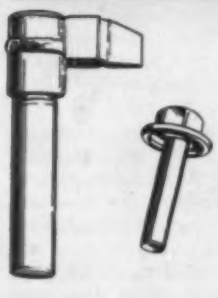
It is impossible for anyone to examine a heading die configuration and then to make a reliable recommendation for heat treatment. Case depth is often a matter of "cut and try to get the best die life." This problem is immediately simplified if the second variable, grain growth, can be nullified. The vanadium addition in the Hedervan restricts grain growth and permits the retention of a very fine fracture grain size at hardening temperatures as high as 1700F.

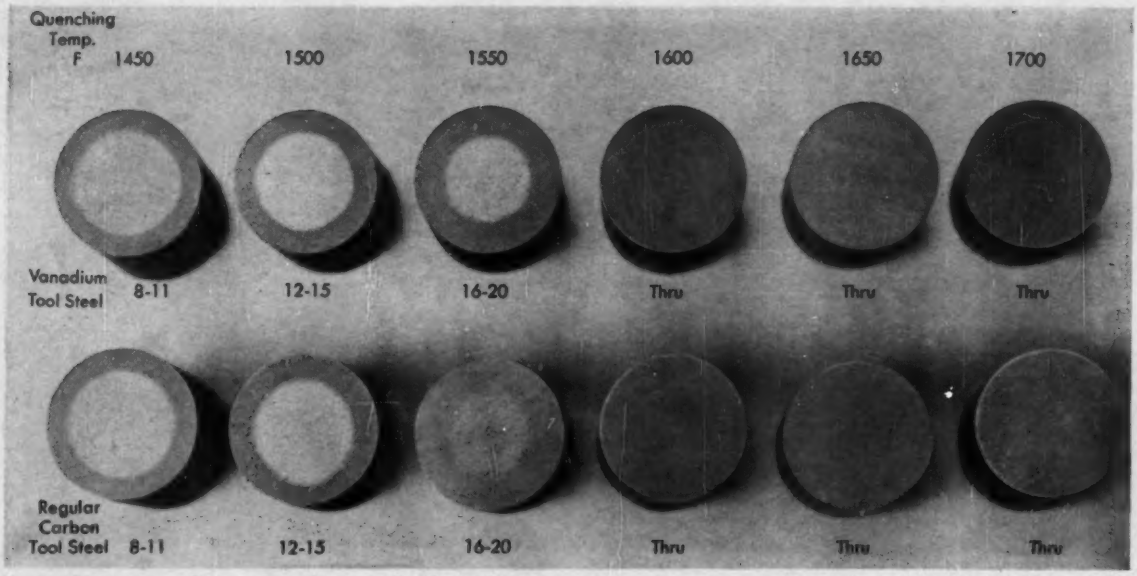
The Shepherd hardenability, or P—F test, has been adopted to express the case-core relationship of a steel in terms of a standard test. Samples ¾-in. in diameter are nor-

Donald Tanger, assistant chief engineer of National Screw & Mfg Co, Cleveland, mikes a valve lever. His plant did most of the pioneer field work with vanadium tool steel for production applications. Examples of tough jobs are:

Hexagon-washer head bolt of 18-8. Average production per vanadium tool-steel die equalled 40,588 blanks, or 8 times better than from a W-1 heading steel

Valve lever of C 1010 steel represents a difficult offset-head design





Hardenability of vanadium tool steel is virtually identical with regular carbon tool steel, which means that a known case-core relationship can be duplicated. Depths of hardenability in 64ths are given under each specimen

malized, then quenched from austenitizing temperatures of 1450 to 1600F.

Values of case penetration P are recorded in 64ths versus quenching temperature; likewise the fracture grain size F. (See Table I). High fracture numbers indicate fine grain size and good toughness; lower numbers are related to coarse grains and loss of toughness.

One grade to stock

Because the entire desired range of case-core ratios is available with this one material (merely by adjusting the austenitizing temperature) inventory savings are obvious.

Hardenability of the vanadium alloy is identical to that of regular carbon tool steel with conventional hardenability characteristics. Therefore case depths can be virtually identical if both steels are quenched from the same austenitizing temperature.

While the initial cost of the vanadium tool steel is higher than that of 0.90%-carbon, water-hardening tool steel, the extra cost is more than offset by labor and machine downtime saved according to Donald Tanger, assistant chief engineer, National Screw & Manufacturing Co, Cleveland. He reports that overall production has been increased at least 3 to 1, and that more than 2000 different Hedervan dies are used there.

Besides fasteners, other uses for the alloy now include cold coining dies, tube drawing dies and mandrels, rotary swaging dies, and punches. •

Table I—Comparison of Case-Core Relationships in 0.90% Carbon and High-Vanadium Tool Steel

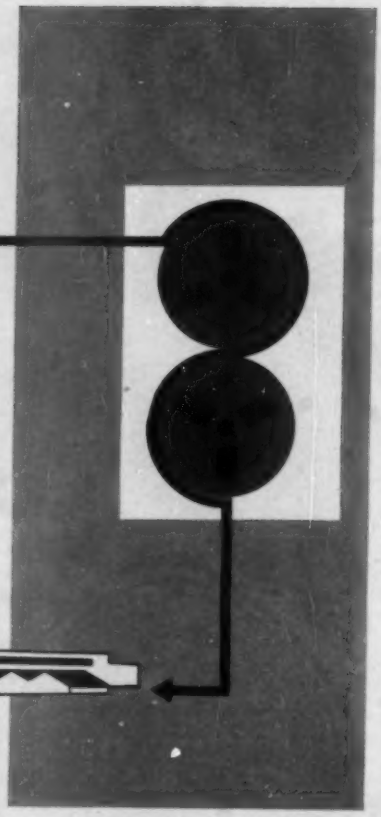
Quenching Temperature F	Shepherd Hardenability Values			
	Penetration (64ths)		Fracture Grain Size	
	0.90% Carbon	Vanadium Tool Steel	0.90% Carbon	Vanadium Tool Steel
1450	8-11	8-11	9½	10
1500	12-15	12-15	9½	10
1550	16-20	16-20	8½	10
1600	24 (thru)	24 (thru)	7½	10
1650	24 (thru)	24 (thru)	7	9½
1700	24 (thru)		5	9½

Grain size of carbon tool-steel (right) normally coarsens considerably with increase in austenitizing temperature. Note fine grain of vanadium tool steel (left)

How a COMPUTER changes your company

Installing a computer may alter your company's organization and policies drastically. Here is what management must do before it invests in electronic data processing

By Morrison H Watkins, administrative assistant to the president, Frank C Brown & Co, New York, NY



EDPM really stands for Every Damn Problem Multiplied. That has been the opinion of more than one management man who has suffered through the birth pangs of electronic data-processing methods in his firm.

Today's high-speed, general-purpose computers give management a superb chance to integrate business routines. But the mere idea of installing a computer brings up all sorts of ticklish questions:

- What should we do with old equipment?
- How should we regroup and retrain personnel?
- What experts should we hire?
- What form should data gathering, processing, and reporting take?

No company that invests in a computer should ignore any of these vital problems. If management is willing to attack them realistically, the results can be very rewarding. But when the approach is superficial, and does not recognize the impact that EDPM has on the company's organization and basic procedures, the entire investment is jeopardized.

Much has been written about the technical prowess of computers, and the various ways they can process business data. The area that has not been adequately covered, it seems to me, is the effect that modern computers have on *organization and procedure policy*.

Our concern here is not so much with what the computer does to business data as with what it does to the company. After all, no matter how marvelous the computer, it is a useless piece of expensive equipment unless the company has a concrete plan for reshaping its structure to accommodate the new arrival.

Initial planning

Once a company decides to look into electronic data processing, one of management's first steps should be to set up an Organization and Procedures group. If it is to be really effective, this group should report at a high-enough level to influence the whole company—not just one of the small segments.

The man who heads this O & P group must be of high caliber, the peer of every top-level department head in the firm. Under him must be a staff of men who can talk the same language as the operating people. Besides being able to understand and appreciate operating problems, these staff men must also be persuasive enough to suggest changes and get them accepted. The point here is that changes are necessary: *Merely converting present routines* seldom gives an efficient EDP installation. The O & P group must have the authority to recommend changes in the firm's basic structure, not its veneer.

The goal of this group is to give management planning and control information. For a company does not integrate data handling merely to reduce paperwork costs, but to speed decision making and to set up a system that coordinates all its varied routines. Whether or not the company eventually decides to invest in a computer, the O & P investigation alone can bring some highly valuable recommendations. In some areas, for instance, the best solution may be to stop collecting data rather than to process it better and faster.

Complex decisions

Coordination of all these changes demands a high degree of administrative ability. There must be a thorough understanding of what the company's needs are, and whether the computer can really integrate these needs. Decisions will have to be made in all sorts of complex areas:

1. What information should each level of management get from the integrated setup?
2. How frequently should each report be made available?
3. What different types of analysis should be made—for what reasons?
4. Will stored information be avail-

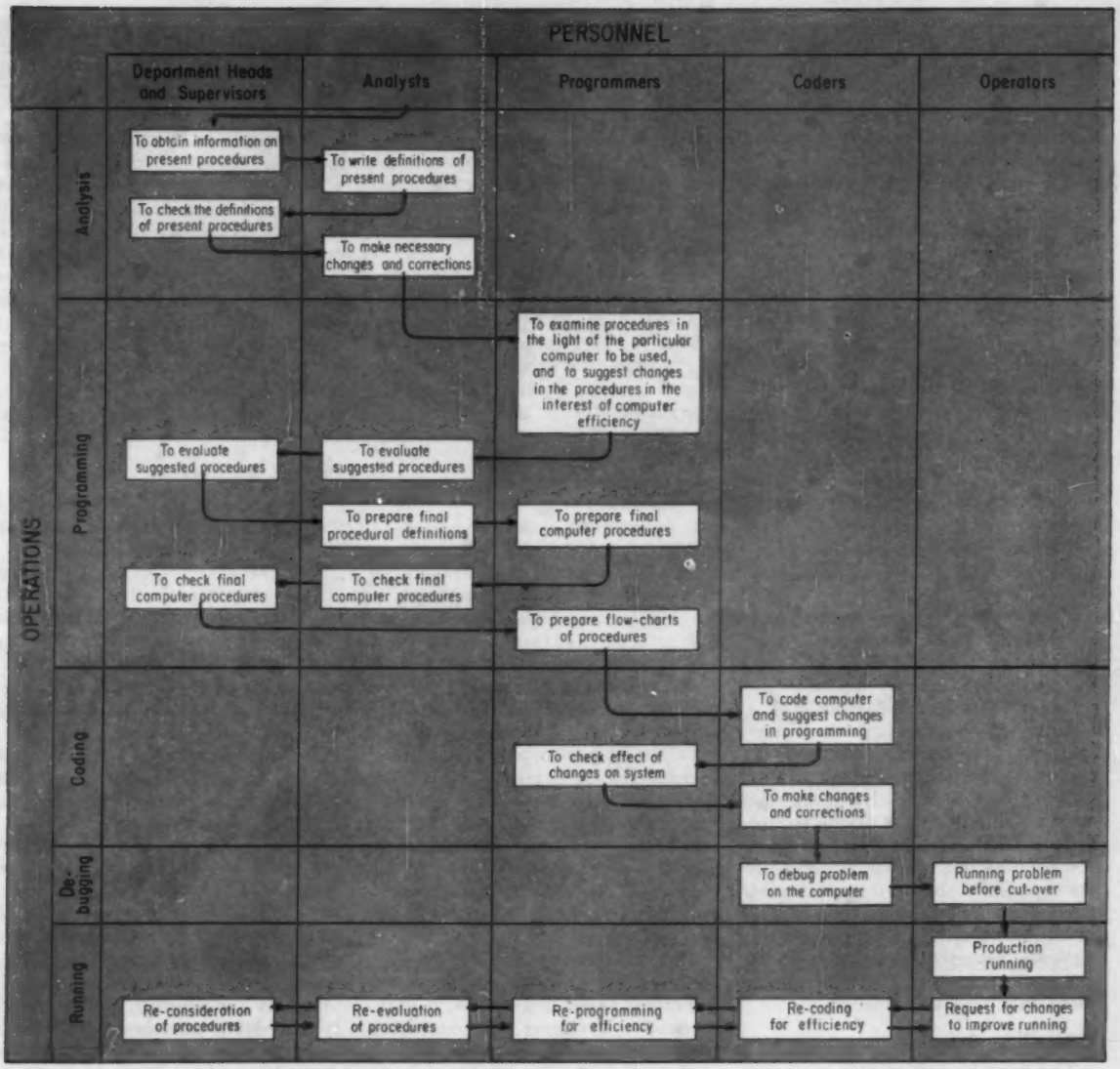

PERSONNEL
Department Heads and Supervisors
Analysts
Programmers
Coders
Operators
OPERATIONS
Analysis
Programming
Coding
De-bugging
Running
To obtain information on present procedures
To write definitions of present procedures
To check the definitions of present procedures
To make necessary changes and corrections
To examine procedures in the light of the particular computer to be used, and to suggest changes in the procedures in the interest of computer efficiency
To evaluate suggested procedures
To evaluate suggested procedures
To prepare final procedural definitions
To prepare final computer procedures
To check final computer procedures
To check final computer procedures
To prepare flow-charts of procedures
To code computer and suggest changes in programming
To check effect of changes on system
To make changes and corrections
To debug problem on the computer
Running problem before cut-over
Production running
Re-consideration of procedures
Re-evaluation of procedures
Re-programming for efficiency
Re-coding for efficiency
Request for changes to improve running

Chart shows flow of work, with feedback paths, involved in preparing a business problem for computer solution (reprinted from *Manual of Digital Techniques*)

able when a special report has to be prepared?

5. Will the computer improve access to daily and periodic accounting statistics: billing, inventory, cost accounting, payroll, accounts payable, cash disbursements?

6. Can Production's requirements be integrated—in scheduling, shop orders, purchasing?

7. How about the Personnel Department's figures for manpower, labor turnover, and the like?

8. Can the Sales Department get better sales and market statistics?

9. Will the computer accommodate miscellaneous data: legal figures, tax reports, census reports?

10. What about the needs of internal and public auditors? They must understand the system, because they have to have proper check points. The computer doesn't have to change basic accounting principles, but the accountant must be able to judge whether these principles are being applied properly.

Thorough data collecting

What are the next steps that management, keeping all these variables in mind, should take?

We should remember that in most companies today the accumulation, filing, and use of data is largely a departmental—even a personal—affair. Here each major function decides what it wants to do, and does it. And each department records and files and tabulates and reports in its own fashion. The result is of course a phenomenal duplication of effort.

Management must make a study, in precise detail, of all these organization relationships and procedures. (The key word here is *precise.*) A general outline simply is not enough. Every operating head has to be consulted, and top management must be fully aware of what is going on at every level in the company.

Naturally, some people will resist such a thoroughgoing study. Information may be withheld from the procedures analyst, who may not be able to get the help he needs. Many people (let's admit it) are afraid of

what the computer will do to their jobs, once it is installed.

But the analyst must get this information. When the time comes for him to write the detailed procedures that will be programmed into the computer, he must have precise, accurate data. For the computer cannot, as a clerk can, bridge gaps by using judgment or by asking the supervisor what to do with this or that exception.

In many a company, this detailed O & P study has been the best move it ever made. Just as often as not, the decision here will be to adopt a *less expensive, less complicated* way to process data. The ideal solution of every company is not, in other words, to buy or rent a computer. In cases like this, all the company needed was a basic study that clearly revealed the *real* problem.

Computers do not solve management problems. They can solve only mathematical problems.

It isn't always easy to convince lower and middle management that their requirements for control information must be based on what the computer can do (and what it can't do). It is especially hard when management is used to manual presentations patterned after their own ideas.

What the O & P head and his staff must do, during this planning period, is to discuss all the needs with all the people involved—at all levels of management—and to synthesize all these needs into a workable, unified plan. The goal here is a plan that answers the greatest number of requirements in terms of the equipment that will be installed.

Presenting the plan

The presentation of this plan is a vital step. The O & P group should make every effort to show, in graphic form, exactly what the input requirements will be — and what the computer output will look like. It should hold meetings with each level of management, presenting flow charts and replicas of new forms. At this stage, the use of slides and blowups will help.

The group should also draft written procedures that anyone can evaluate and make comments on. When operating people get a clear preview of the proposed system, they can much more readily appreciate why the computer demands a new concept of company organization. Moreover, this O & P groundwork shows why everyone will have to follow the procedures set down in the new operating manual.

We should always remember that an electronic computer does not erase paperwork problems. It can in fact compound them. Although its speed and versatility enable it to pour out almost limitless reports, it cannot help a company make better decisions simply because there are more reports available.

Processing data

After the O & P group has completed its exhaustive spadework, the company can begin to think about how it is going to process its data. At this stage it's important to define, as precisely as possible, three general subjects:

1. What data is available for putting into the computer?
2. What data should come out of the computer?
3. How much should come out — and at what rate of flow?

Once you know the answers in these three areas, you can begin to build an integrated communication system.

Before data can be put into a computer, it must of course be prepared for processing. Special equipment does the job, transcribing source data onto tapes or cards (by direct punch, mark sensing, etc). The source data, in other words, is converted into the language of the electronic system. The language-carrying medium (the input to the computer) may be punched cards, paper tape, or (by far the fastest) magnetic tape.

The computer has this function: *Directed by a series of stored instructions called a program, it automatically performs all assembly, sorting, classification, reference, and arithmetic operations.* Is it any wonder that, if you're going to get effective results, the preliminary systems and procedures work is so important!

Once the card or tape infeed goes into the computer, it is stored in the computer file or memory — on magnetic tape, a magnetic drum, or magnetic disks. After the operation, output can be on magnetic tape, punched cards, punched tape, or (via special printers) on printed documents. With the proper planning, this output will be meaningful to many divisions of the company—not just Purchasing alone, or Sales, or Production.

Benefits of planning

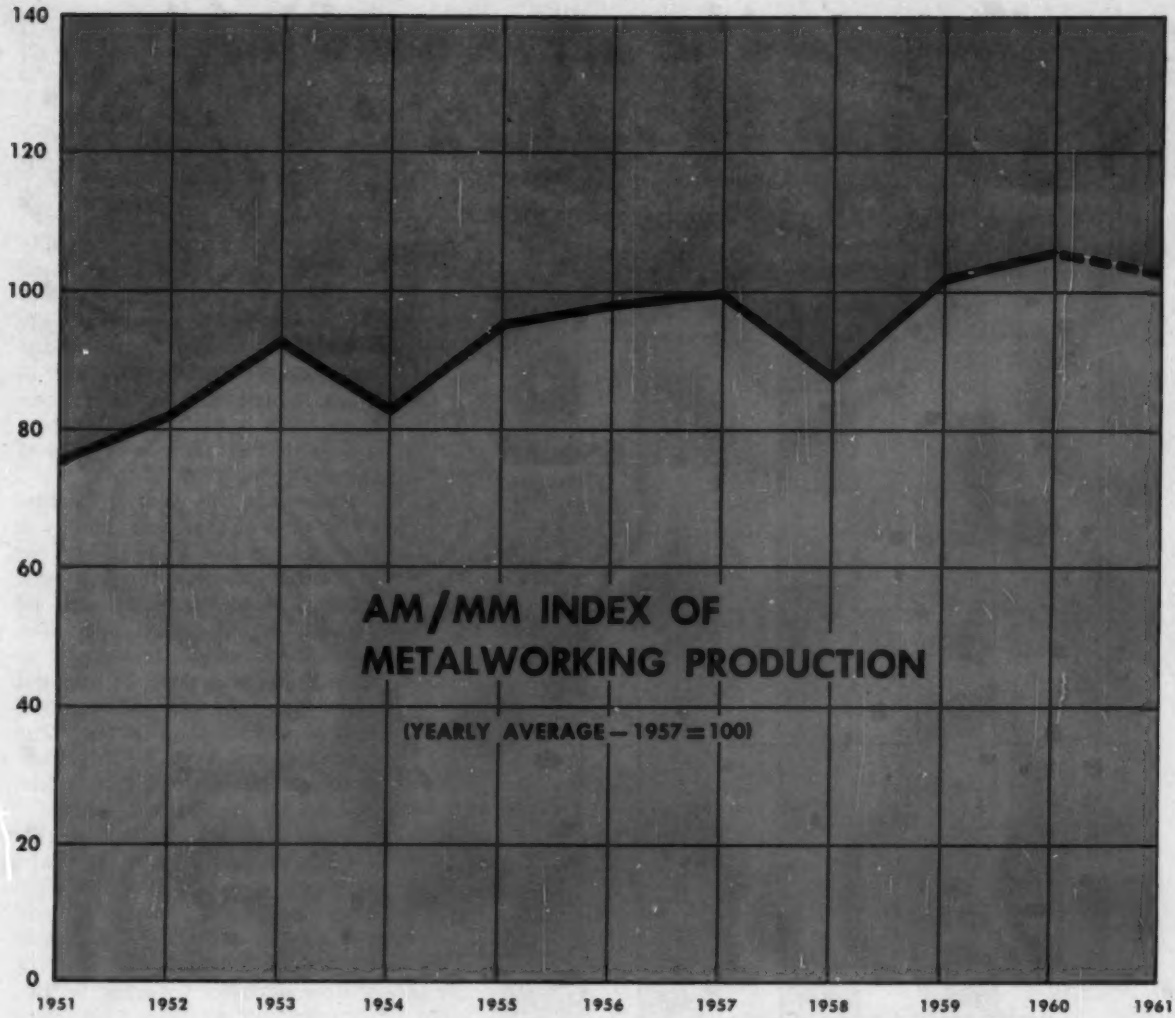
If the careful planning that we have outlined above *does* show that your company can make effective use of a computer, then (and only then) should you make the decisive step toward EDP. Then a computer becomes practical; then it may help you to process your data more efficiently than in the past.

We could list many examples of the time and effort that a computer will save. One company's experience is typical. Under its old system, this company processed about 25,000 invoices a month; the average for an 8-hour day was 1250. With its new computer system, the company can process 1250 in an hour. At the same time, it gets a daily sales summary, an up-dated inventory, and the profit or loss on each invoice. In addition, errors have been dropped to a fraction of 1%.

Further pointers

If you have just begun to think about electronic data processing, consider the following pointers:

- *Make your study the hard way.* In the long run, the extra time will pay off. Hitting only the high spots, and getting to conclusions faster, may seem less expensive, but many companies have learned to their regret that such assumptions are faulty. In too many of these over-hasty firms, the installation has never got off the ground, and management has had finally to retrace its steps and make a thorough study.
- *Look into at least four or five different systems.* More than 200 are now available, but you cannot look at all of them. The best thing to do: Find out which companies that make general-purpose computers have the best service facilities in your city (or nearby). Having readily accessible advisors is extremely important during the installation and de-bugging phases.
- *Make full use of the manufacturer's technical staff.* These men know a great deal about what their equipment can do, and they usually will know how applicable the equipment is to the solution of your particular problem. Most computer makers will try to be as helpful as they can during your planning stage, because this is the time they make the sale or lose it.
- *Look at other installations.* Arrange, if you can, to look over an operating installation in a company that is about the size of yours. The product line doesn't have to be the same as yours, because most business data tends to be roughly similar. If you can get someone to talk about the problems he faced — and how he overcame them — it will help you tremendously. •



1961: Output of metal goods to stay close to peacetime record

American Machinist / Metalworking Manufacturing *Special Report No. 501 January 9, 1961*

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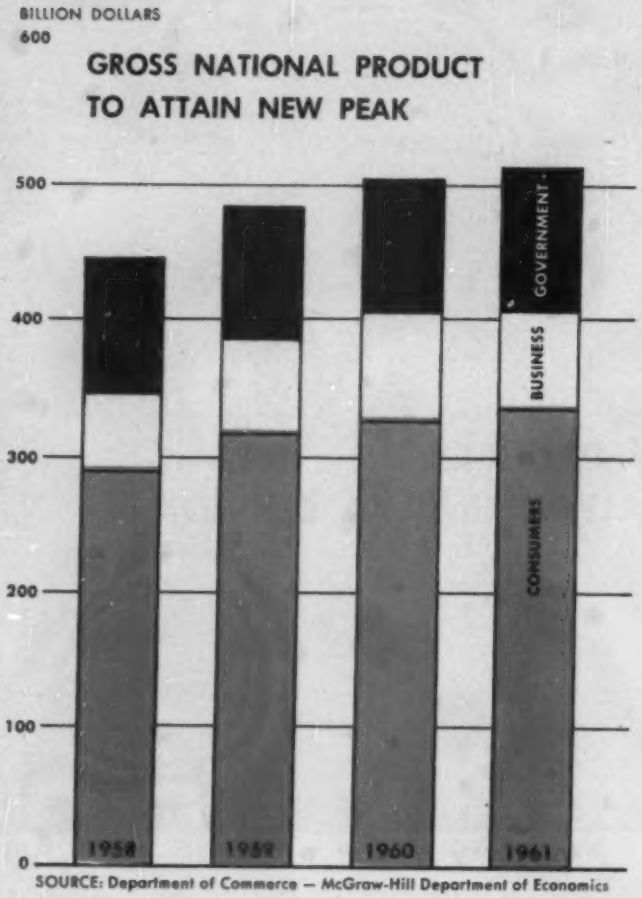
Output to be near record level



SOURCE: Department of Commerce — McGraw-Hill Department of Economics

R&D SPENDING TO RISE FURTHER

	1959 ACTUAL	1960 EST.	1963 PLANNED
	MILLION DOLLARS		
R&D SPENDING			
Machinery	678.0	745.8	880.0
Electrical Machinery	1,607.9	1,800.8	2,161.0
Aircraft & Parts	3,250.3	3,250.3	3,250.3
Fabricated Metal Products	223.0	263.1	336.8
Prof. & Scientific Inst.	382.9	413.5	512.7
All Other Metalworking	808.3	820.3	901.8
Metalworking Total	6,950.4	7,293.8	8,042.6
All Other Manufacturing	1,706.0	1,845.7	2,183.6
All Non-Manufacturing	370.6	415.1	485.7
Total	9,027.0	9,554.6	10,711.9

SOURCE: McGraw-Hill Department of Economics

Physical volume of goods to be manufactured in the metalworking industry this year probably will fall short of last year's total. Output measured by the AM/MM Production Index should average around 103 compared with 106 the past year (1957 = 100). Bear in mind, though, that the 1960 average of 106 is the highest on record, with the single exception of the peak war year of 1943.

Shipments this year, measured in dollar volume, may top by a slim margin the all-time high of $141 billion attained the past year. If this should happen, it will be because manufacturers will take goods from inventory as well as from production lines. It does not mean that dollar volume of output will be greater than in 1960. The fact is that last year's shipments exceeded 1959's by 5% in dollars and by 3% in physical volume.

Come the second half of this year, operations in the metalworking industry should set a new high. They will benefit from recovery in the capital goods and the consumer durable goods fields. The recovery will be partially triggered by rising expenditures for new plant and equipment and for replacement of old machinery to compete more successfully in a price-conscious economy. It also will be helped by the continuous stream of new products coming into production for the first time as the payoff of all-time peak spending for research and development.

A quick appraisal of the outlook in various segments of metalworking reveals these prospects: 1) gain of about 5% in production of household appliances; 2) increase of 8% in electronics manufacture, to a total of $11.5 billion for the year; 3) a slight upturn in overall production of farm implements; 4) mild downturn in automobile assemblies; 5) expansion of 5% in instrument and control products; 6) increase of 2% in machinery shipments.

OUTLAY FOR NEW PLANT AND EQUIPMENT

(Billions of Dollars)

Fall Survey (Nov. 18, 1960)	Released Actual 1959	Est. 1960	Planned 1961	1962
Iron & steel	$1.04	$1.52	$1.37	$1.18
Nonferrous metals	.31	.34	.34	.32
Machinery	.91	1.15	1.11	1.11
Electrical machinery	.52	.62	.68	.63
Autos, trucks & parts	.64	.89	.95	1.02
Transportation equipment (Aircraft, ships, r.r. equip.)	.39	.41	.37	.35
Other metalworking	.88	.97	.85	.87
Chemicals	1.24	1.61	1.64	1.59
Paper & pulp	.63	.75	.69	.53
Rubber	.19	.24	.23	.20
Stone, Clay & Glass	.53	.63	.56	.55
Petroleum & coal products	2.49	2.45	2.52	2.50
Food & beverages	.82	.94	.99	.97
Textiles	.41	.53	.42	.40
Miscellaneous manufacturing	1.07	1.28	1.21	1.13
ALL MANUFACTURING	12.07	14.33	13.93	13.35
Mining	.99	.99	.90	.89
Railroads	.92	1.04	.79	.83
Other transportation & communications	4.69	5.20	4.61	4.18
Electric & gas utilities	5.67	5.89	6.14	6.01
Commercial	8.21	8.61	8.70	8.54
ALL BUSINESS	32.55	36.06	35.07	33.80

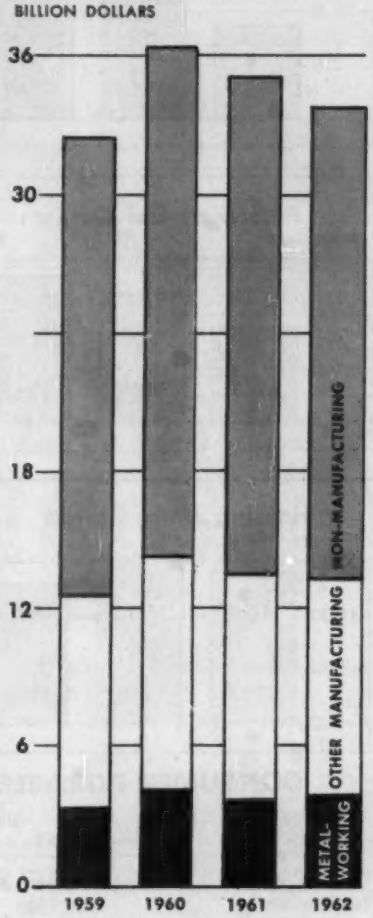
SOURCE: McGraw-Hill Department of Economics

WHERE METALWORKING IS INVESTING ITS MONEY

	New Eng.		Mid-Atlu.		So. Atl.		No. Cent.		South		West	
	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961	1960	1961
Machinery	9	9	26	24	3	3	50	52	7	8	5	4
Elec. Mach.	8	4	34	34	8	9	35	45	11	3	4	5
Autos	0	0	8	7	*	2	76	76	10	11	6	4
Trans. Eqpt.	6	6	9	7	9	9	17	17	4	2	55	59
Other Metal	13	14	21	19	11	9	24	26	16	17	15	15
Metalworking	8	7	20	19	6	6	44	47	10	9	12	12

*Less than .5%

NEW PLANT & EQUIPMENT EXPENDITURES



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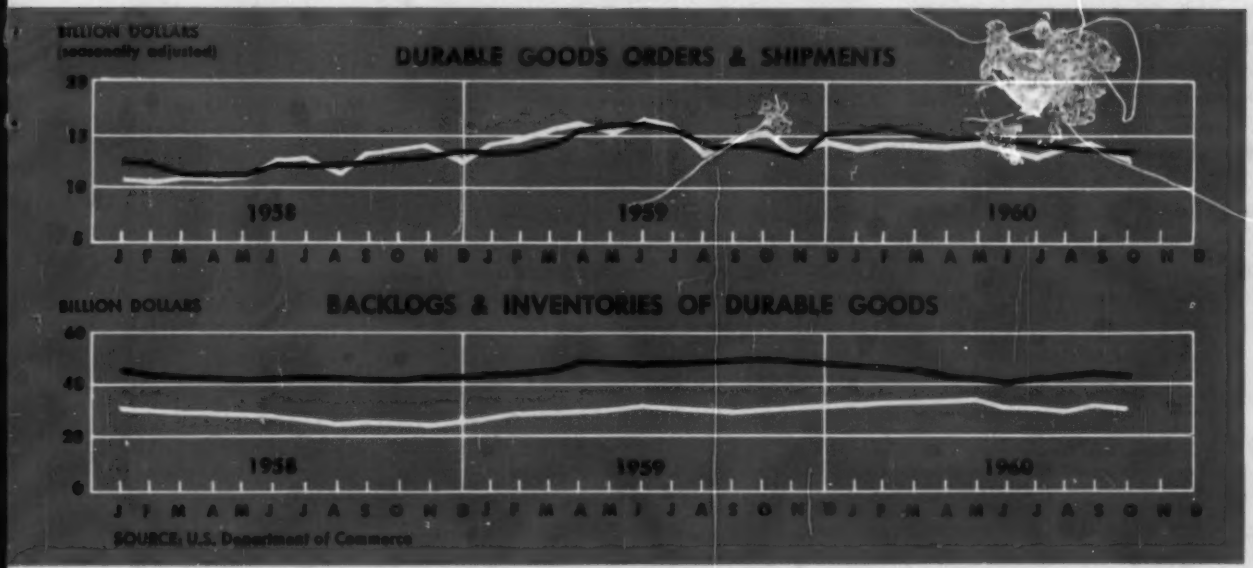
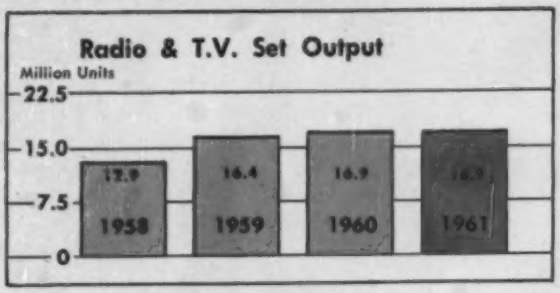
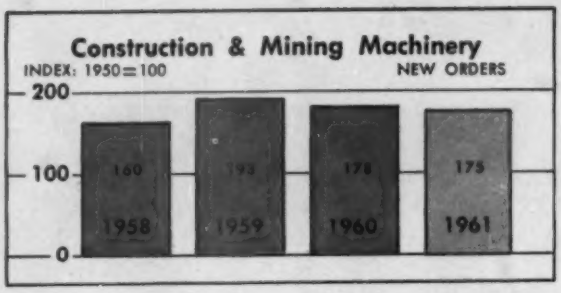
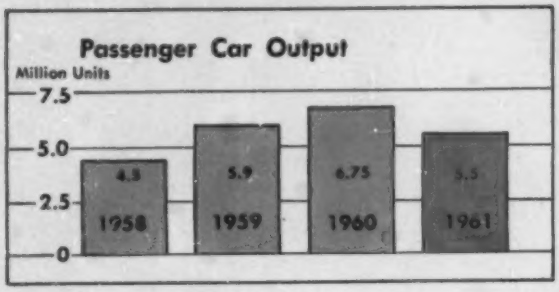
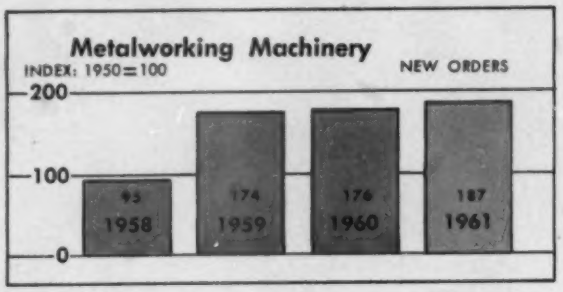


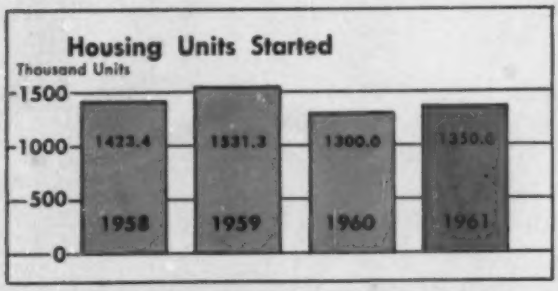
1961: NEAR RECORD YEAR . . .

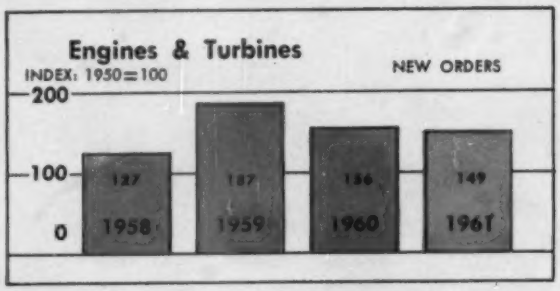












CONSUMER DURABLE GOODS

	1958	1959	1960
Passenger cars (U.S.)	4,540,677	5,894,580	6,750,000
Television sets	4,921,000	6,350,000	6,600,000
Radios	8,032,000	10,067,000	10,270,000
Washers: Standard size	3,692,000	3,833,300	3,535,000
Vacuum cleaners (floor type)	3,295,000	3,421,000	3,387,000
Ranges	1,354,500	1,686,800	1,485,000
Domestic cooking stoves (non el.)	1,896,400	2,010,500	1,950,000
Domestic heating stoves (non el.)	2,121,462	2,318,900	2,133,000
Oil burners	577,227	652,600	550,000
Warm air furnaces	1,185,631	1,417,400	1,320,000
Non-electric water heaters	2,673,400	2,956,000	2,715,000
Refrigerators	3,116,700	3,785,000	3,310,000
Air conditioners (room)	1,673,000	1,773,000	1,627,000
Freezers	1,100,900	1,205,400	1,085,000
Civil Aircraft (Shipments) T.$	493,851	899,637	1,325,000
Housing starts (units)	1,423,400	1,531,300	1,300,000

INDUSTRIAL GOODS

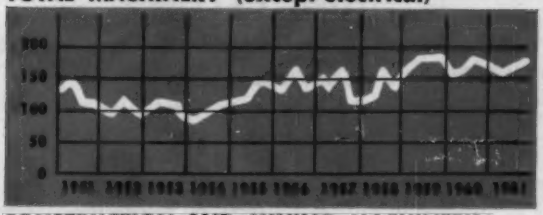
	1958	1959	1960
Trucks (U.S. Units)	930,040	1,191,590	1,200,000
Blowers & Fans (New Orders in $1000)	126.7	148.2	152.2
Unit Heater Group (New Orders in $1000)	77.7	85.8	88.0
Foundry Equipment (47-49=100)	107.0	142.6	126.0
Pumps (New Orders in $1000)	66.4	72.4	85.0
Polyphase Induction Motors (Shipments in $1000)	144,889	170,022	173,500
Direct Current Motors (Shipments in $1000)	20,511	30,398	28,500
Industrial Supplies (N.O. Index)	169	208	195
Freight Cars (units)	44,282	38,447	58,800
Railroad Cars — Passenger	130	70	193
Materials Handling Equp't. Bookings 54=100	109	132	129
Gear Shipments (Index 1947-49=100)	164.0	234.7	243.0
Industrial Electric Trucks (units)	8,960	9,564	11,650
Engines-Turbines (N.O. Index 1950=100)	127	187	156
Office Machinery (N.O. Index 1950=100)	163	186	213
Metalworking Machinery (N.O. Index 1950=100)	95	174	176
Const. & Mining Machinery (N.O. Index 1950=100)	160	193	178
Industrial Fasteners Shipments (N.O. Index 1956-58=100	84	101	96

Source: U.S. Bureau of Labor Statistics, Ward's Automotive Reports, RETMA, American Home Laundry Manufacturers Assn., Vacuum Cleaner Manufacturers Assn., NEMA, Air Conditioning and Refrigeration Institute, U.S. Dept. of Commerce, Facts For Industry, Foundry Equipment Manufacturers Assn., Materials Handling Equipment Assn., American Gear Manufacturers Assn., American Supply and Machinery Manufacturers Assn., McGraw-Hill Department of Economics

FORECAST: New Orders for Machinery

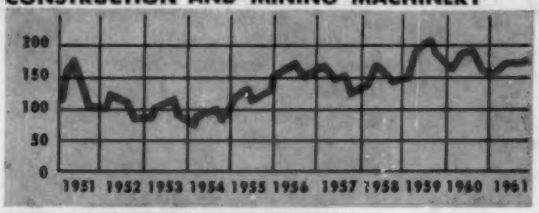
(Quarterly Adjusted, 1950 = 100)

TOTAL MACHINERY (except electrical)



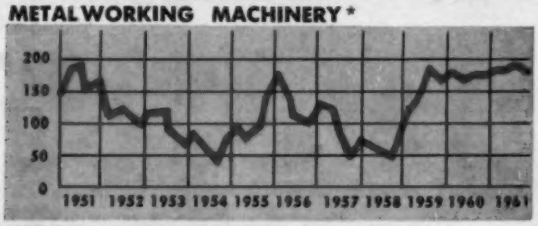
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1 Qtr.	149	96	100	82	102	140	149	122	168	169	156*
2 Qtr.	132	101	107	87	118	149	143	134	177	180	166*
3 Qtr.	119	103	100	92	134	159	156	158	178	176	177*
4 Qtr.	117	94	88	100	143	141	122	144	156	168*	

CONSTRUCTION AND MINING MACHINERY*



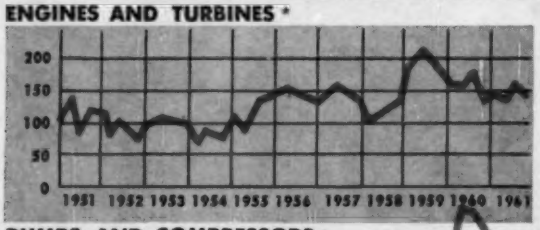
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1 Qtr.	194	124	111	87	139	166	174	142	196	193	174*
2 Qtr.	148	115	113	95	131	172	151	183	215	197	174*
3 Qtr.	106	88	80	90	134	159	152	156	193	161	175*
4 Qtr.	101	91	74	112	155	166	127	157	168	162*	

METALWORKING MACHINERY*



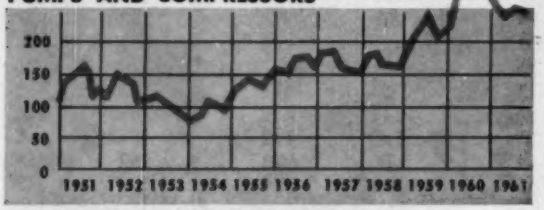
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1 Qtr.	235	150	145	103	134	219	166	87	150	168	183*
2 Qtr.	248	151	147	96	123	168	161	79	190	175	193*
3 Qtr.	206	150	108	84	140	152	130	96	172	176	186*
4 Qtr.	204	134	100	102	222	150	87	116	182	183*	

ENGINES AND TURBINES*



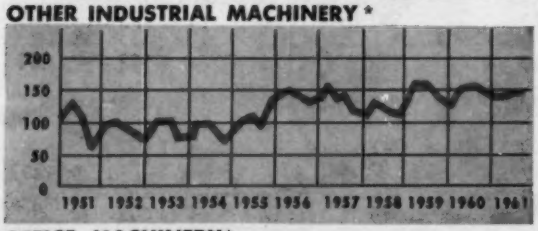
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1 Qtr.	153	98	99	81	106	166	145	108	197	161	140*
2 Qtr.	109	106	102	92	128	148	149	107	208	180	158*
3 Qtr.	121	81	94	84	143	148	149	137	182	138	149*
4 Qtr.	109	92	91	106	143	140	157	145	162	146*	

PUMPS AND COMPRESSORS*



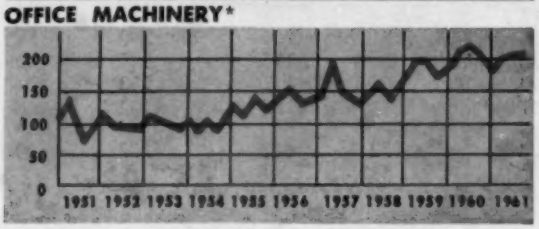
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1 Qtr.	150	127	118	98	132	156	189	189	233	327	244*
2 Qtr.	178	156	120	107	145	185	190	169	252	321	258*
3 Qtr.	128	118	106	105	141	186	156	175	207	297	252
4 Qtr.	135	117	92	114	154	183	152	179	230	265*	

OTHER INDUSTRIAL MACHINERY*



	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1 Qtr.	147	90	100	92	100	136	144	123	163	154	145*
2 Qtr.	114	86	101	85	112	144	135	135	164	161	149*
3 Qtr.	86	81	81	76	102	129	135	145	143	150	150*
4 Qtr.	101	82	80	87	123	127	121	137	131	145*	

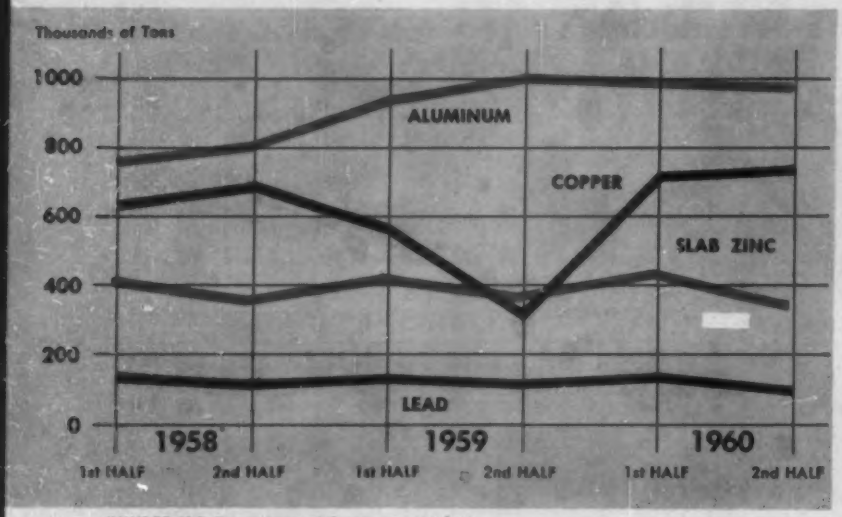
OFFICE MACHINERY*



	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
1 Qtr.	144	103	107	98	114	138	166	154	196	220	203*
2 Qtr.	115	95	96	107	128	151	193	148	197	227	210*
3 Qtr.	85	88	89	93	118	134	153	162	166	215	212*
4 Qtr.	104	97	107	120	123	145	141	184	195	192*	

*UNADJUSTED SOURCE: McGraw-Hill Economics Department

* Forecast made in mid-October 1960



SOURCE: U.S. Department of Commerce; AM/MM

No pickup in nonferrous demand

Producers of nonferrous metals expect to ship about the same tonnage in 1961 as in 1960. The aluminum people are the only group estimating that production this year will be higher than last. A modest gain of 5% will come from the auto industry, where aluminum is being used more freely, and from construction field. Copper producers will get a good share of the bigger building volume, but other uses will drop off.

METALS PRODUCTION
Net Production — Thousands of Tons

	1958		1959		1960	
	1st HALF	2nd HALF	1st HALF	2nd HALF	1st HALF	2nd HALF
PIG IRON	25,453	31,847	42,074	28,247	41,165	31,057
Basic	21,333	26,943	36,833	15,318	36,130	27,470
Foundry	749	873	1,032	857	779	639
STEEL INGOTS & CASTINGS	38,311	47,980	63,609	29,352	59,024	42,000
Open Hearth	33,930	42,219	56,755	25,360	53,459	38,000
Bessemer	685	803	1,068	391	896	640
Electric	3,696	4,958	5,786	3,601	4,669	3,360
ALLOY STEEL INGOTS	2,479	3,218	5,101	2,608	4,532	3,332
Carbon Boron	5	8	20	7	9	6
Chromium	361	604	933	508	723	577
Chromium — Molybdenum	295	379	558	309	517	378
Chromium — Vanadium	19	25	42	24	40	22
Manganese	63	103	138	70	139	100
Manganese — Molybdenum	89	114	233	96	243	127
Molybdenum	203	274	423	172	371	288
Nickel	23	30	28	17	29	28
Nickel — Chromium	37	32	54	21	53	30
Nickel — Chromium — Molybdenum	430	512	841	439	736	526
Nickel — Molybdenum	119	126	230	162	188	149
Silico — Manganese	23	43	50	23	52	55
All Other	812	968	1,551	760	1,432	1,046
REFINED COPPER	652	701	580	332	726	749
LEAD	140	126	129	126	132	110
SLAB ZINC	410	372	425	380	450	370
ALUMINUM	763	801	942	1,011	1,007	1,000
CASTINGS						
Steel	463	394	596	517	602	482
Gray Iron	2,765	3,099	3,813	3,189	3,534	3,150
Malleable	183	201	291	266	263	210
Copper & Copper Base Alloy	176	183	206	196	195	180
Zinc & Zinc Base Alloy	159	193	226	217	223	204
Aluminum & Aluminum Base Alloy	210	217	291	254	272	258
COMMERCIAL STEEL FORGINGS	540	722	772	603	727	550

SOURCE: American Iron and Steel Institute; U.S. Dept. of Commerce; Facts for Industry; AM/MM

WHERE STEEL IS USED	Tons		% CHANGE	RATIO TO TOTAL TONNAGE	
	1959	1960	1959 to 1960	1959	1960
STEEL for converting & processing	3,133,407	2,976,000	− 5.0%	4.5%	4.0%
FORGINGS, other than automotive	956,893	950,000	− 0.7	1.4	1.3
BOLTS, nuts, rivets & screws	1,071,142	1,060,000	− 1.0	1.5	1.4
JOBBERS, total	13,048,754	13,200,000	+ 1.1	18.8	17.7
Oil & Gas Industry	1,890,416	1,325,000	−29.9	2.7	1.8
All others	11,158,338	11,875,000	+ 6.4	16.1	16.0
CONSTRUCTION & Maintenance	8,514,178	10,075,000	+18.3	12.3	13.5
CONTRACTORS products	3,573,196	3,700,000	+ 3.5	5.1	5.0
AUTOMOTIVE, total	14,213,875	15,060,000	+ 5.9	20.5	20.2
Cars, trucks, parts, etc.	13,792,395	14,590,000	+ 5.8	19.9	19.6
Forgings	421,480	470,000	+11.5	.6	.6
RAIL transportation, total	2,356,840	3,018,500	+28.1	3.4	4.0
Rails, trackwork & equipment	763,381	935,000	+22.5	1.1	1.2
Freight & passenger cars, locomotives	1,571,796	2,050,000	+30.4	2.3	2.7
Street railways & rapid transp.	21,663	33,500	+54.6	*	*
SHIPBUILDING & Marine equipment	641,887	540,000	−15.9	.9	.7
AIRCRAFT	71,343	77,000	+ 7.9	.1	.1
OIL & Gas drilling	540,538	450,000	−16.7	.8	.6
MINING, quarrying & lumbering	234,945	276,000	+17.5	.3	.4
AGRICULTURAL, total	1,264,988	1,033,000	−18.3	1.8	1.4
Agricultural machinery	964,429	793,000	−17.8	1.4	1.1
All other	300,559	240,000	−20.1	.4	.3
MACHINERY, industrial equipment & tools	4,158,328	4,039,000	− 2.9	6.0	5.4
ELECTRICAL machinery & equipment	2,051,577	2,010,000	− 2.0	2.9	2.7
APPLIANCES, utensils & cutlery	1,829,202	1,828,000	− 0.1	2.6	2.4
OTHER domestic & commercial equipment	1,832,766	1,985,000	+ 8.3	2.6	2.7
CONTAINERS, total	6,318,229	7,055,000	+11.7	9.1	9.5
Cans & closures	5,010,615	5,545,000	+10.7	7.2	7.4
Barrels, drums & shipping pails	772,797	870,000	+20.4	1.1	1.2
All other containers	534,817	640,000	+19.7	.8	.9
ORDNANCE & other military	127,434	142,000	+11.4	.2	.2
EXPORT	1,408,477	2,765,000	+96.3	2.0	3.7
UNCLASSIFIED	2,029,068	2,140,000	+ 5.5	2.9	2.9
TOTAL	69,377,067	74,379,500	+ 7.2	100.0	100.0

SOURCE: American Iron & Steel Institute; AM/MM

*less than .05%

Steel to gain as year goes on

The steel industry will set no records in 1961. In fact, output of steel ingots may well fall short by about 5% of the 1960 total of 101 million tons. But as the year progresses, steel operations will get better. The industry's production performance the second half will be more impressive than in the first half.

Steel has suffered ever since the scramble for tonnage by consumers just before and after the big steel strike. For months steel customers have been paring their inventories to such a point that they now count on mills to make quick deliveries. This policy of carrying a bare minimum of stocks, which is a throwback to the 1930s, is likely to continue indefinitely, according to industry observers.

From now on, steel production will conform pretty closely to steel consumption. In 1961 such important steel users as auto makers, railroads, industrial machinery builders and shipbuilders will take less steel than last year. On the other hand, the construction industry, farm implement people and container companies will take more.

Steel exports recovered sharply last year, almost doubling the tonnage of the previous year. Actual steel tonnage chewed up in 1960 increased 5 million tons compared with the strike year of 1959. Shipments to the construction field, rail transportation and auto people were responsible.

1961: NEAR RECORD YEAR . . .

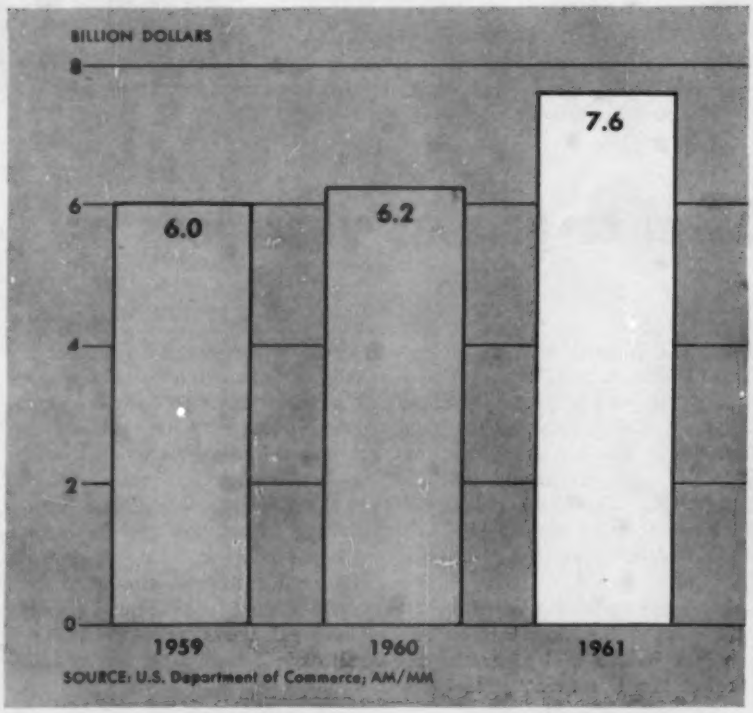
EXPORTS	MILLIONS OF DOLLARS 1959-ACTUAL	1960	% CHANGE 1959-1960
Metalworking Total	6,010.3	7,193.1	+19.7%
Electrical Machinery & Apparatus	954.5	985.3	+3.2
Power Generating Equipment	247.5	228.4	−7.7
Construction, Excavating, Mining Machinery, etc.	690.2	765.2	+10.9
Machine Tools & Parts	153.6	195.4	+27.2
Metalworking Machines, Parts & Accessories	157.9	149.3	−5.4
Textile, Sewing & Shoe Machinery	108.0	140.1	+29.7
Other Industrial Machines & Parts	849.9	979.0	+15.2
Office Machines & Parts	145.5	191.3	+31.5
Printing & Bookbinding Machinery	40.7	47.2	+16.0
Agricultural Machines, Implements & Parts	143.9	147.4	+2.4
Tractors, Parts & Accessories	354.8	396.3	+11.7
Autos, Trucks, Buses & Trailers, Parts & Access.	1,136.4	1,360.2	+19.7
Aircraft, Parts & Accessories	769.0	1,404.2	+82.6
Watercraft	112.8	34.3	−69.6
Railway Trans. & Equipment	103.5	132.1	+27.6
Other Vehicles & Parts	7.1	7.1	0
Special Category Items Not Included Above	35.0	30.3	−13.4

SOURCE: Dept. of Commerce; AM/MM

Exports to continue uptrend

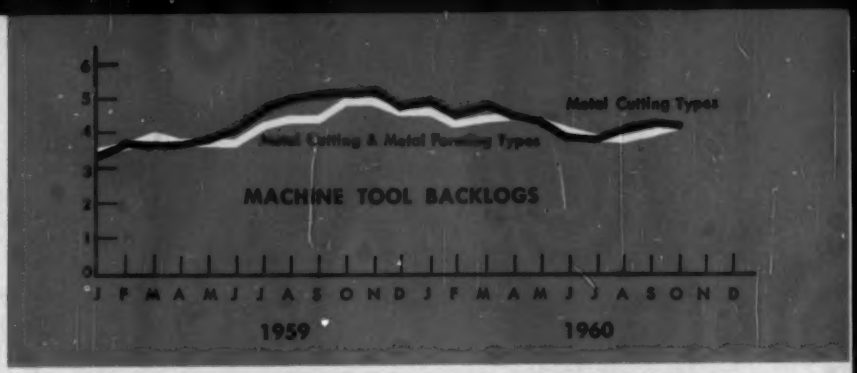
Exports of metal goods were up a thumping 20% the past year and promise to rise another 6% this year. Measured in dollars, the total in 1961 will reach $7.6 billion, compared with $7.2 billion during 1960. Biggest boost will be in electrical machinery, where shipments will run one-fifth higher than the past year. These gains are remarkable in the face of the fact that so many U S companies have established manufacturing facilities overseas.

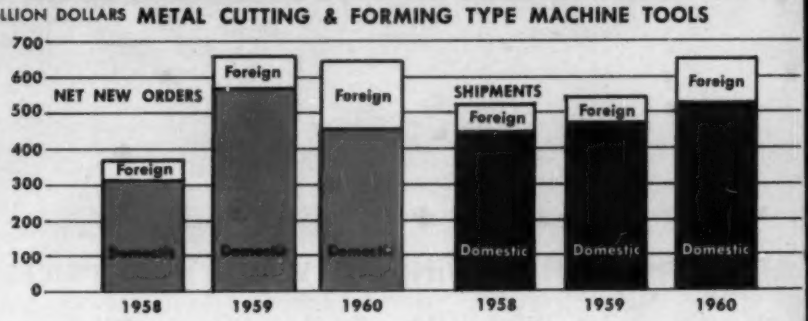
The aircraft industry, with export of jet planes, nosed out the auto industry for first place in export shipments in 1960. New compact cars helped spur auto sales abroad. Healthy gains in exports occurred last year in machine tools, office machinery, railway equipment and textile sewing machinery. Canada took $1.5 billion of goods, against Common Market's $800 million.



Modest gain in machine tools

New orders for machine tools are likely to show a modest increase this year over last. Even so, the total volume will be considerably short of making 1961 a big year. As in 1960, export business should be good—from western Europe, Japan and even Latin America. Automotive buying will be larger, but still far below the levels of the better years. Bookings from domestic customers are expected to be bigger in the second half than the first.





METAL CUTTING & FORMING

	Million Dollars Net New Orders	Shipments	
1958	Total	Total	Domestic
Jan.	$ 26.9	$ 57.8	$ 50.8
Feb.	28.3	48.1	43.2
Mar.	36.2	54.2	48.5
Apr.	28.3	50.9	44.2
May	28.1	50.1	41.7
Jun.	32.1	45.5	38.9
July	26.6	29.7	24.5
Aug.	28.3	29.8	25.0
Sep.	28.1	34.9	29.7
Oct.	37.0	41.4	35.9
Nov	30.7	33.7	27.5
Dec.	43.0	42.9	36.9
Total	**$373.4**	**$518.8**	**$446.6**
1959			
Jan.	$ 41.1	$ 31.3	$ 25.8
Feb.	45.4	36.1	29.9
Mar.	51.6	45.8	39.4
Apr.	53.2	45.0	38.3
May	48.7	41.0	36.3
Jun.	65.4	50.1	45.0
July	63.4	40.6	37.0
Aug.	52.2	40.3	35.4
Sep.	58.9	46.2	42.3
Oct.	66.7	51.5	46.2
Nov.	54.2	46.6	41.1
Dec.	58.7	63.6	55.6
Total	**$659.4**	**$537.9**	**$471.9**
1960			
Jan.	$ 56.5	$ 46.5	$ 40.6
Feb.	60.6	51.9	44.6
Mar.	62.0	64.5	54.9
Apr.	51.9	55.0	45.0
May	49.9	56.3	44.7
Jun.	55.1	63.1	51.0
Jul.	43.0	51.2	41.4
Aug.	56.8	47.9	37.7
Sep.	52.2	53.9	40.2
Oct.	56.0	49.7	35.4

METAL CUTTING TYPES

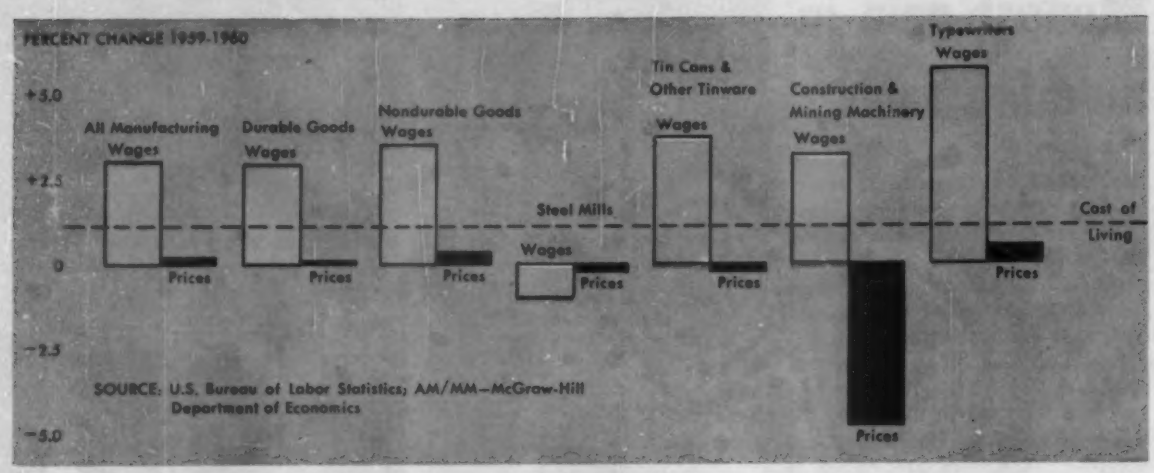
	Million Dollars Net New Orders	Shipments	
1958	Total	Total	Domestic
Jan.	$ 19.3	$ 47.8	$ 42.0
Feb.	22.8	38.5	34.4
Mar.	29.5	45.9	41.3
Apr.	22.9	40.2	35.0
May	21.9	37.6	32.7
Jun.	23.0	35.5	30.9
July	20.9	23.2	18.9
Aug.	19.3	23.2	19.3
Sep.	20.1	27.2	23.1
Oct.	28.5	32.8	29.2
Nov.	22.3	25.5	21.4
Dec.	30.2	33.1	28.5
Total	**$280.5**	**$410.2**	**$356.6**
1959			
Jan.	$ 29.1	$ 23.4	$ 20.0
Feb.	36.0	27.1	22.0
Mar.	40.3	37.9	32.4
Apr.	40.4	33.3	28.6
May	37.5	30.4	27.5
Jun.	53.9	37.2	33.4
July	50.8	31.2	28.9
Aug.	42.3	31.1	27.0
Sep.	47.7	36.3	33.3
Oct.	43.6	40.2	36.6
Nov.	41.9	34.2	30.6
Dec.	46.0	51.6	45.9
Total	**$509.4**	**$413.6**	**$365.9**
1960			
Jan.	$ 43.5	$ 36.8	$ 31.8
Feb.	47.7	40.0	34.3
Mar.	48.5	51.1	44.1
Apr.	36.7	43.9	36.3
May	37.9	44.3	35.4
Jun.	42.6	48.4	38.0
July	33.5	39.4	31.4
Aug.	47.8	36.5	29.0
Sep.	42.1	41.0	29.9
Oct.	35.6	39.8	27.7

METAL FORMING TYPES

	Million Dollars Net New Orders	Shipments	
1958	Total	Total	Domestic
Jan.	$ 7.6	$ 10.0	$ 8.8
Feb.	5.5	9.6	8.8
Mar.	6.7	8.3	7.2
Apr.	5.4	10.7	9.2
May	6.2	12.5	9.1
Jun.	9.1	10.1	8.0
July	5.7	6.5	5.6
Aug.	9.1	6.7	5.7
Sep.	8.0	7.7	6.6
Oct.	8.6	8.7	6.8
Nov.	8.5	8.2	6.1
Dec.	12.8	9.8	8.4
Total	**$ 92.9**	**$108.7**	**$ 90.1**
1959			
Jan.	$ 12.0	$ 7.9	$ 5.8
Feb.	9.5	9.0	7.9
Mar.	11.3	7.9	7.0
Apr.	12.8	11.8	9.7
May	11.2	10.7	8.8
Jun.	11.5	12.9	11.5
July	12.7	9.4	8.2
Aug.	10.0	9.3	8.4
Sep.	11.2	9.9	9.0
Oct.	23.1	11.3	9.6
Nov.	12.3	12.4	10.5
Dec.	12.7	12.0	9.7
Total	**$150.0**	**$124.3**	**$106.0**
1960			
Jan.	$ 13.0	$ 9.7	$ 8.8
Feb.	12.9	11.9	10.3
Mar.	13.5	13.4	10.8
Apr.	15.2	11.1	8.7
May	12.0	12.0	9.3
Jun.	12.5	14.7	13.0
July	9.5	11.8	10.0
Aug.	9.0	11.4	8.7
Sep.	10.1	12.9	10.3
Oct.	20.4	9.9	7.7

SOURCE: National Machine Tool Builders' Association

1961: NEAR RECORD YEAR . . .



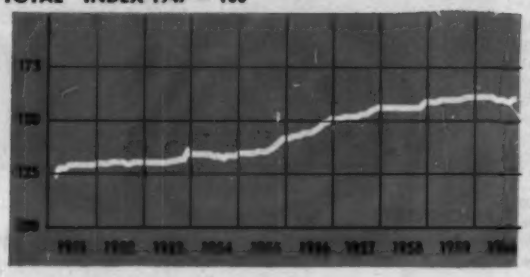
WHAT'S HAPPENING TO WAGES AND PRICES

	AV. HOURLY WAGES			PRICES 1947-49 = 100		
	1959	1960	% change	1959	1960	% change
All Manufacturing Industries	$2.22	$2.29	+3.1	125.5	125.7	+0.2
Durable Goods	2.38	2.45	+2.9	147.0	147.1	+0.1
Non-durable Goods	2.00	2.07	+3.5	108.5	108.8	+0.3
Steel Mills	3.10	3.07	−1.0	205.1	204.6	−0.2
Gray Iron Foundries	2.40	2.46	+2.5	154.0	158.6	+3.0
Malleable Iron Foundries	2.38	2.41	+1.2	181.0	181.0	0
Steel Foundries	2.55	2.60	+1.9	187.0	187.6	+0.3
Iron and Steel Forgings	2.84	2.87	+1.0	N.A.	N.A.	N.A.
Wire Drawings	2.65	2.65	0	166.8	175.8	+5.4
Tin Cans & Other Tinware	2.65	2.75	+3.7	154.3	154.0	−0.2
Cutlery & Edge Tools	1.98	2.02	+2.0	173.0	174.0	+0.6
Hand Tools	2.27	2.33	+2.6	185.8	189.1	+1.8
Hardware	2.31	2.41	+4.3	159.0	159.4	−0.2
Oil Burners, Non-Electric Heating & Cooking Apparatus	2.24	2.32	+3.5	121.8	119.8	−1.6
Structural Steel & Ornamental Metalworking	2.40	2.46	+2.5	136.6	132.5	−3.0
Boiler Shop Products	2.45	2.51	+2.4	129.9	134.0	+3.1
Sheetmetal Work	2.46	2.53	+2.8	105.0	106.6	+1.5
Stamped and Pressed Metal Products	2.60	2.71	+4.2	197.7	199.0	+0.6
Machinery (except electrical)	2.49	2.56	+2.8	158.8	159.9	+0.7
Engines and Turbines	2.67	2.78	+4.1	155.4	155.7	+0.2
Tractors	2.65	2.66	+0.3	138.0	140.1	+1.5
Agricultural Machinery (except tractors)	2.44	2.48	+1.6	149.3	152.5	+2.1
Construction and Mining Machinery	2.46	2.54	+3.2	184.1	175.3	−4.8
Machine Tools	2.52	2.60	+3.1	N.A.	N.A.	N.A.
Metalworking Machinery (except machine tools)	2.62	2.71	+3.4	174.0	179.0	+2.9
Machine Tool Accessories	2.80	2.85	+1.7	173.8	174.5	+0.4
Special Industrial Machinery	2.33	2.41	+3.4	N.A.	N.A.	N.A.
General Industrial Machinery	2.45	2.51	+2.4	164.8	166.9	+1.3
Computing Machinery & Cash Registers	2.67	2.75	+2.9	128.0	128.8	+0.6
Typewriters	2.10	2.22	+5.7	148.0	148.7	+0.5
Service, Industrial & Household Machinery	2.39	2.45	+2.5	104.8	102.2	−2.5
Refrigerators, and Air Conditioning Units	2.41	2.47	+2.4	88.8	83.4	−6.1
Electrical Machinery	2.22	2.29	+3.1	154.7	154.5	−0.1
Communications Equipment	2.14	2.22	+3.7	N.A.	N.A.	N.A.
Radios, Phonographs, Television Sets and Equipment	2.12	2.17	+2.3	93.8	91.5	−2.5
Automobiles	2.70	2.79	+3.3	143.2	139.8	−2.4
Aircraft	2.63	2.70	+2.6	N.A.	N.A.	N.A.
Aircraft, Engines and Parts	2.63	2.71	+3.0	N.A.	N.A.	N.A.
Ship and Boat Building and Repairing	2.60	2.67	+2.6	N.A.	N.A.	N.A.
Locomotives and Parts	2.72	2.78	+2.2	N.A.	N.A.	N.A.
Railroads and Street Cars	2.75	2.82	+2.5	N.A.	N.A.	N.A.

SOURCE: U.S. Bureau of Labor Statistics; AM/MM

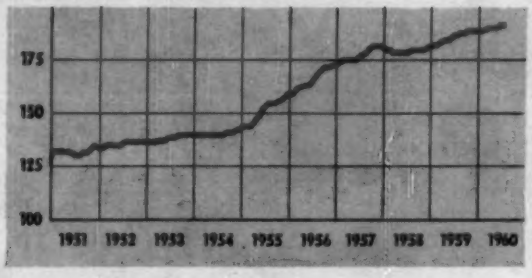
AM/MM Index of Metalworking Prices

TOTAL INDEX 1947 = 100



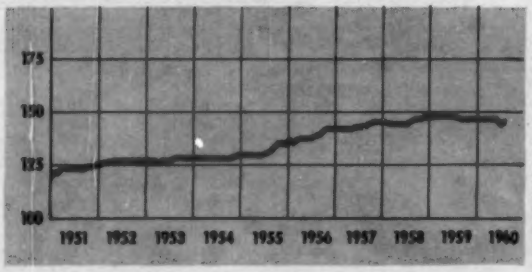
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	126.7	129.2	129.8	132.9	133.9	141.5	151.1	156.2	158.2	159.6
FEB	127.1	130.0	129.8	132.8	134.2	141.9	151.5	156.0	158.4	159.8
MAR	127.8	129.8	129.6	132.8	134.2	142.1	151.7	156.0	158.5	159.7
APR	127.8	129.7	129.9	132.6	134.5	143.5	151.9	155.9	158.5	159.8
MAY	127.8	129.7	130.4	132.4	134.7	143.9	151.9	155.8	158.7	159.6
JUN	127.8	129.4	130.9	132.5	135.1	144.0	151.9	155.9	159.2	159.4
JUL	127.8	129.4	131.5	132.4	135.8	144.6	152.7	155.8	159.3	159.4
AUG	127.8	129.6	132.1	132.6	137.1	145.5	153.4	155.8	159.4	159.4
SEP	128.2	129.6	132.5	132.8	139.0	147.5	153.9	155.8	159.7	158.2
OCT	128.7	129.6	135.2	132.7	139.9	149.1	154.7	156.3	159.5	159.4
NOV	128.9	129.5	132.6	133.5	140.9	150.8	155.9	157.5	159.5	159.6
DEC	129.1	129.7	132.6	133.8	141.3	150.5	156.2	157.9	159.6	

METALWORKING MACHINERY



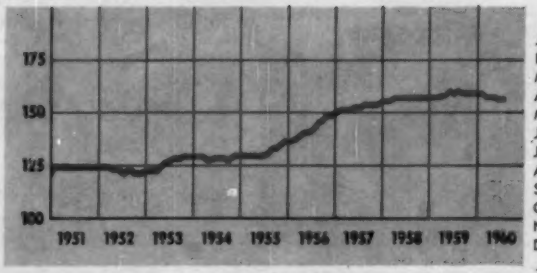
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	133.8	136.2	137.8	141.8	144.3	160.9	174.5	183.0	182.4	189.8
FEB	133.8	136.8	137.8	142.0	145.9	161.5	174.9	182.5	182.6	189.7
MAR	133.8	136.6	137.9	142.0	146.2	162.2	176.1	182.3	183.8	190.4
APR	133.8	136.6	138.6	141.6	146.4	164.3	176.5	182.3	184.2	190.4
MAY	133.7	136.7	138.9	141.6	149.0	165.0	176.9	181.1	184.9	191.2
JUN	133.2	136.6	140.2	141.6	152.4	165.8	176.9	180.9	185.7	192.2
JUL	133.2	137.8	140.8	141.6	155.4	165.8	177.4	181.2	185.6	192.4
AUG	133.5	137.9	140.9	141.7	156.7	167.8	178.4	180.8	187.8	192.4
SEP	134.2	138.0	141.8	142.4	156.9	170.5	180.3	180.8	187.9	193.3
OCT	135.3	137.9	141.7	143.1	157.2	172.4	182.4	181.6	188.6	193.3
NOV	136.7	137.7	141.8	143.1	158.1	174.1	183.0	181.6	188.8	
DEC	137.2	137.8	141.8	143.9	158.6	174.4	183.0	182.2	189.7	

FABRICATED METAL PRODUCTS



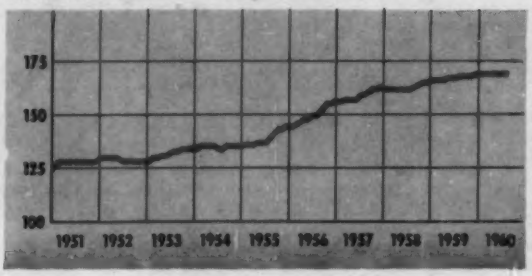
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	123.1	126.7	128.3	129.3	130.6	136.0	143.1	146.7	148.6	148.0
FEB	123.4	128.2	128.3	129.1	130.5	136.5	143.3	146.6	148.7	148.0
MAR	124.8	128.1	127.6	129.0	130.5	136.4	143.4	146.6	148.7	148.0
APR	124.8	127.9	127.3	128.9	130.8	137.8	143.4	146.4	148.8	147.9
MAY	124.8	127.9	127.6	128.7	130.8	137.5	143.3	146.4	148.8	147.8
JUN	124.8	127.8	127.8	128.7	131.0	137.5	143.2	146.3	148.8	147.7
JUL	124.8	127.8	128.2	128.7	131.5	137.6	144.0	146.2	148.6	147.6
AUG	124.8	128.0	128.8	129.1	132.4	138.5	144.4	146.2	148.5	147.6
SEP	125.3	128.0	129.0	129.2	132.9	140.0	144.5	146.2	148.8	145.2
OCT	126.2	128.2	128.9	129.0	134.7	141.4	144.9	146.7	148.3	147.4
NOV	126.3	128.0	128.9	130.3	135.9	143.3	146.5	148.3	148.2	
DEC	126.6	128.2	128.9	130.7	136.0	143.3	146.8	148.4	148.1	

ELECTRICAL MACHINERY



	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	126.6	126.5	124.5	132.0	132.0	137.8	152.0	157.2	158.9	162.4
FEB	126.8	126.6	124.6	132.0	131.9	137.6	153.1	157.5	158.6	162.4
MAR	126.7	126.5	124.8	132.0	131.6	139.1	153.5	157.5	159.4	162.2
APR	126.8	125.9	126.3	131.7	131.6	141.2	153.9	158.0	159.3	162.2
MAY	126.8	125.8	127.6	130.1	131.7	142.6	154.3	158.5	160.4	160.2
JUN	126.8	124.9	129.3	131.1	131.7	143.2	154.3	158.9	160.5	160.2
JUL	127.2	123.9	129.9	131.0	131.9	143.0	155.6	158.9	162.5	159.6
AUG	127.1	124.7	130.7	130.9	132.9	143.7	155.7	159.1	162.2	159.4
SEP	127.1	124.6	131.4	130.9	136.0	147.8	157.0	158.8	162.5	158.7
OCT	126.8	123.9	131.7	130.3	136.1	149.1	156.9	158.8	162.4	158.7
NOV	127.1	124.4	131.8	131.9	136.8	151.2	157.0	158.6	162.4	
DEC	126.8	124.5	132.0	132.0	137.5	151.4	157.1	158.6	162.1	

OTHER MACHINERY (except electrical)



	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	131.4	132.8	132.4	137.4	138.0	148.1	159.7	166.6	169.3	172.4
FEB	132.1	132.9	132.5	137.5	138.8	148.3	160.0	166.2	169.9	172.8
MAR	132.1	132.5	132.8	137.6	138.9	148.7	160.3	166.0	169.8	172.6
APR	132.1	132.5	133.8	137.5	139.2	149.5	160.6	166.1	169.6	173.0
MAY	132.1	132.5	134.3	137.5	139.5	151.0	160.6	165.8	169.6	173.0
JUN	132.1	132.2	135.0	137.5	139.7	150.9	160.8	166.1	171.0	172.5
JUL	132.2	132.2	135.9	137.3	140.3	152.6	161.4	166.0	171.1	172.6
AUG	132.1	132.2	136.4	137.4	142.6	153.3	162.7	165.9	171.3	172.8
SEP	132.2	132.2	137.0	137.5	145.2	155.3	163.6	165.9	171.5	173.1
OCT	132.3	132.1	137.1	137.6	146.6	157.3	165.1	166.5	171.7	173.3
NOV	132.5	132.2	137.3	137.6	147.4	158.5	166.1	167.8	171.9	
DEC	132.5	132.3	137.4	137.6	148.0	159.0	166.4	168.8	172.3	

1961: NEAR RECORD YEAR . . .

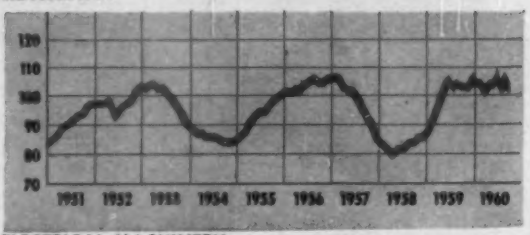
AM/MM Index of Metalworking Production

	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	75	78	94	84	88	97	103	91	95	109
FEB	76	78	94	84	89	96	103	87	96	108
MAR	77	79	95	83	91	95	102	86	98	107
APR	77	79	96	83	93	97	101	83	101	106
MAY	76	81	96	83	94	96	100	85	105	108
JUN	76	81	95	84	94	96	101	86	107	107
JUL	74	75	97	83	96	97	101	88	108	107
AUG	73	79	95	83	97	98	101	89	105	106
SEP	75	85	93	83	97	99	99	89	105	107
OCT	75	87	91	82	99	100	97	89	103	106
NOV	76	90	88	84	98	101	97	93	95	
DEC	77	92	85	85	98	102	93	94	103	

TOTAL METALWORKING INDEX 1957 = 100

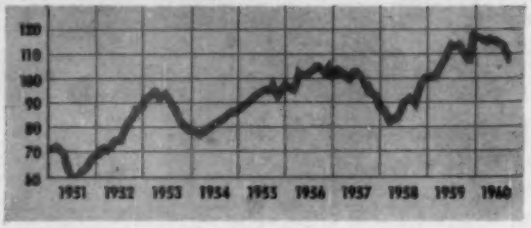
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	84	97	104	90	85	101	106	85	87	106
FEB	85	97	103	89	86	101	106	83	90	104
MAR	86	97	104	88	87	101	106	82	93	104
APR	88	97	104	87	90	102	104	81	97	102
MAY	89	98	104	87	91	102	102	80	101	104
JUN	90	98	103	86	93	103	102	81	104	104
JUL	91	94	103	86	94	104	101	81	105	107
AUG	92	96	102	86	94	105	100	82	103	103
SEP	93	97	100	85	96	106	98	83	104	106
OCT	94	98	98	84	98	105	95	83	103	103
NOV	96	101	95	84	99	105	92	85	103	
DEC	97	103	93	84	100	106	89	85	104	

MACHINERY



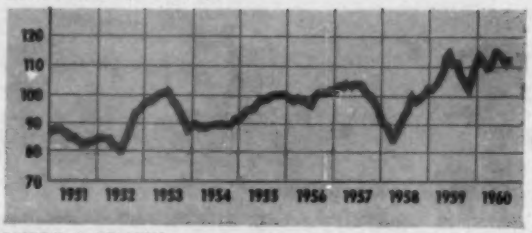
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	72	69	92	79	87	98	102	91	99	117
FEB	72	71	92	79	88	96	104	87	100	115
MAR	73	72	93	78	89	96	103	85	100	115
APR	72	71	94	78	90	104	101	82	103	114
MAY	70	73	94	79	91	103	100	83	107	115
JUN	68	75	92	80	93	101	102	85	110	114
JUL	63	75	94	81	94	103	102	89	113	114
AUG	60	79	92	82	95	104	102	90	112	113
SEP	63	82	89	83	95	105	100	91	113	112
OCT	64	84	86	84	99	105	96	89	112	108
NOV	66	88	83	86	94	103	96	97	108	
DEC	68	88	80	86	96	106	93	99	116	

ELECTRICAL MACHINERY



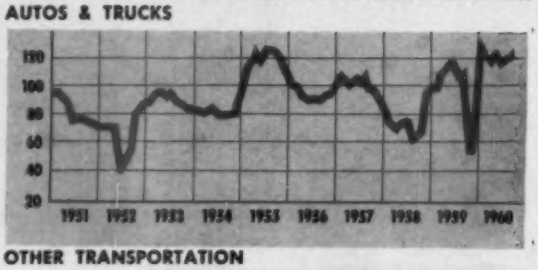
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	86	84	96	88	90	98	100	92	100	111
FEB	87	84	96	88	91	97	101	88	100	111
MAR	87	84	97	87	93	96	101	86	102	110
APR	87	83	98	87	93	97	102	83	105	106
MAY	86	84	98	87	94	96	101	87	109	111
JUN	85	81	99	88	96	96	102	90	112	112
JUL	84	80	100	88	97	95	102	92	112	112
AUG	84	84	98	88	97	97	102	96	108	111
SEP	83	88	96	88	98	99	101	98	108	109
OCT	82	91	95	87	98	99	98	96	104	109
NOV	83	93	91	89	98	99	97	97	101	
DEC	83	95	87	90	98	100	95	100	107	

OTHER METALWORKING



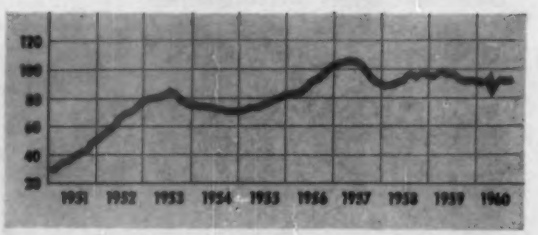
	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	97	72	88	82	105	107	103	84	97	127
FEB	96	72	92	82	111	101	106	79	97	126
MAR	96	74	95	80	116	98	103	72	103	118
APR	91	74	96	81	119	97	100	68	108	115
MAY	89	73	96	83	125	90	101	73	111	120
JUN	85	73	94	84	118	88	104	74	113	120
JUL	76	44	97	81	124	89	102	75	114	113
AUG	77	54	94	79	123	89	104	74	106	115
SEP	77	78	89	79	123	88	108	61	103	117
OCT	76	81	87	79	122	92	96	65	106	120
NOV	75	86	85	83	119	93	94	90	62	
DEC	73	87	84	93	113	98	89	94	94	

AUTOS & TRUCKS



	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
JAN	33	54	80	78	74	81	101	87	94	88
FEB	34	56	81	78	74	82	102	85	94	88
MAR	36	58	81	77	74	82	103	86	94	87
APR	38	60	82	77	75	83	104	86	95	89
MAY	39	63	82	77	75	85	104	88	97	93
JUN	40	66	83	77	75	87	104	89	96	83
JUL	42	68	84	76	76	89	103	90	96	90
AUG	43	70	86	75	77	91	102	94	96	89
SEP	45	71	85	75	78	92	100	95	93	89
OCT	45	74	84	74	79	95	97	94	91	90
NOV	50	76	80	74	80	98	92	96	90	
DEC	52	79	79	74	81	100	89	96	91	

OTHER TRANSPORTATION



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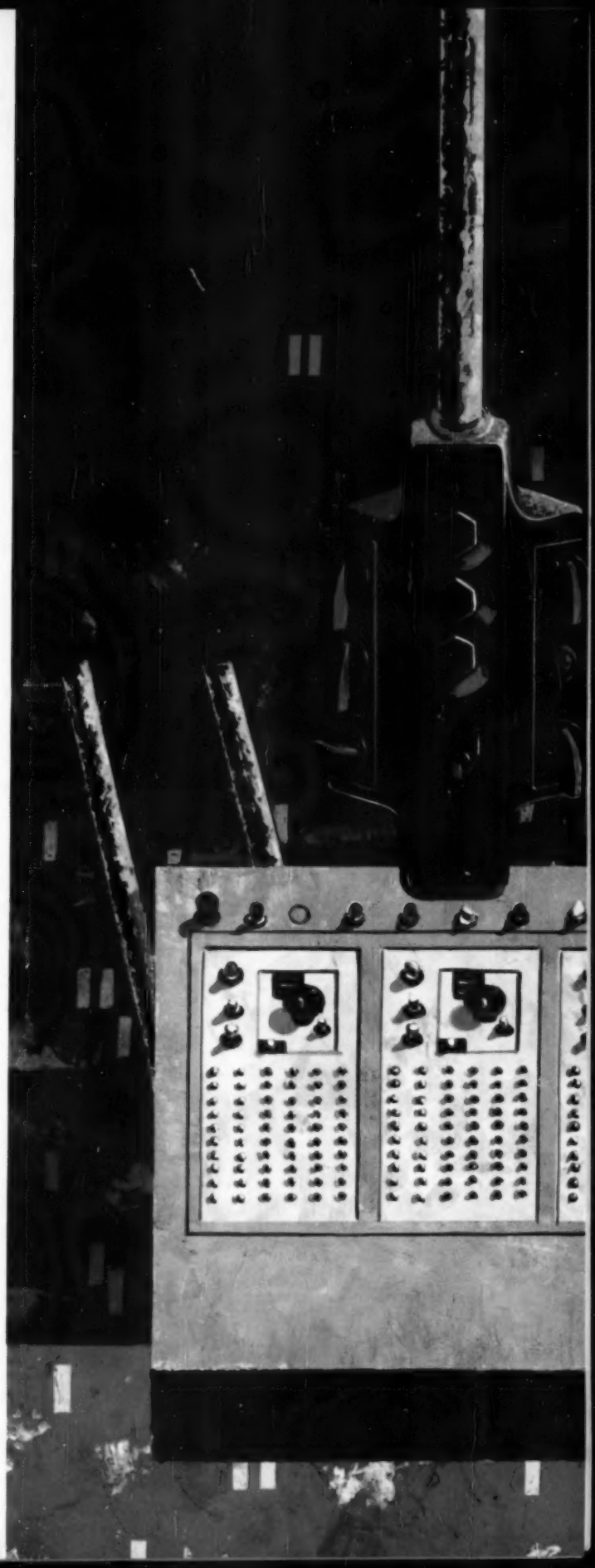

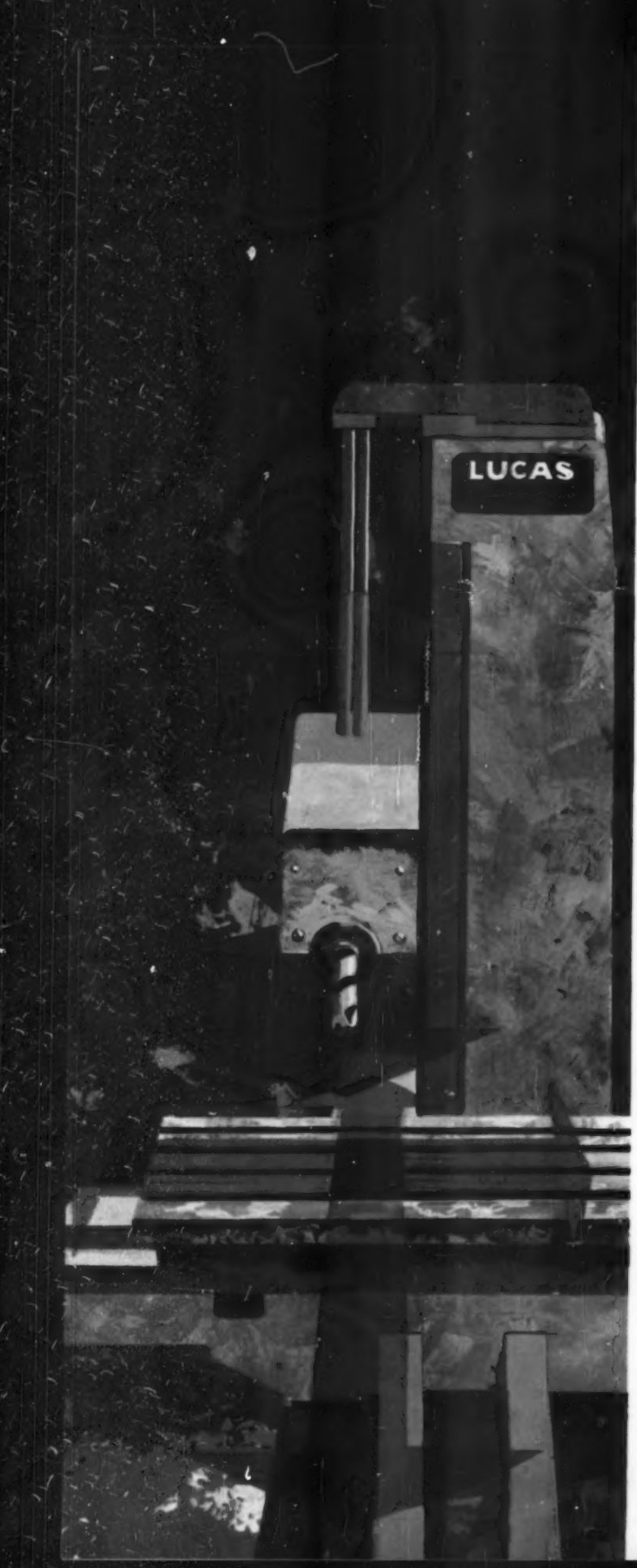

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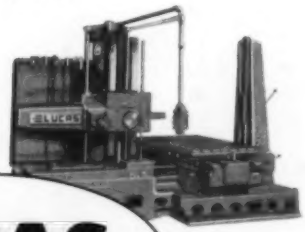


LUCAS
PRECISION

Screw Machine Work on Aluminum—V

By M Bryan Baker, Kaiser Aluminum & Chemical Corp, Oakland, Calif

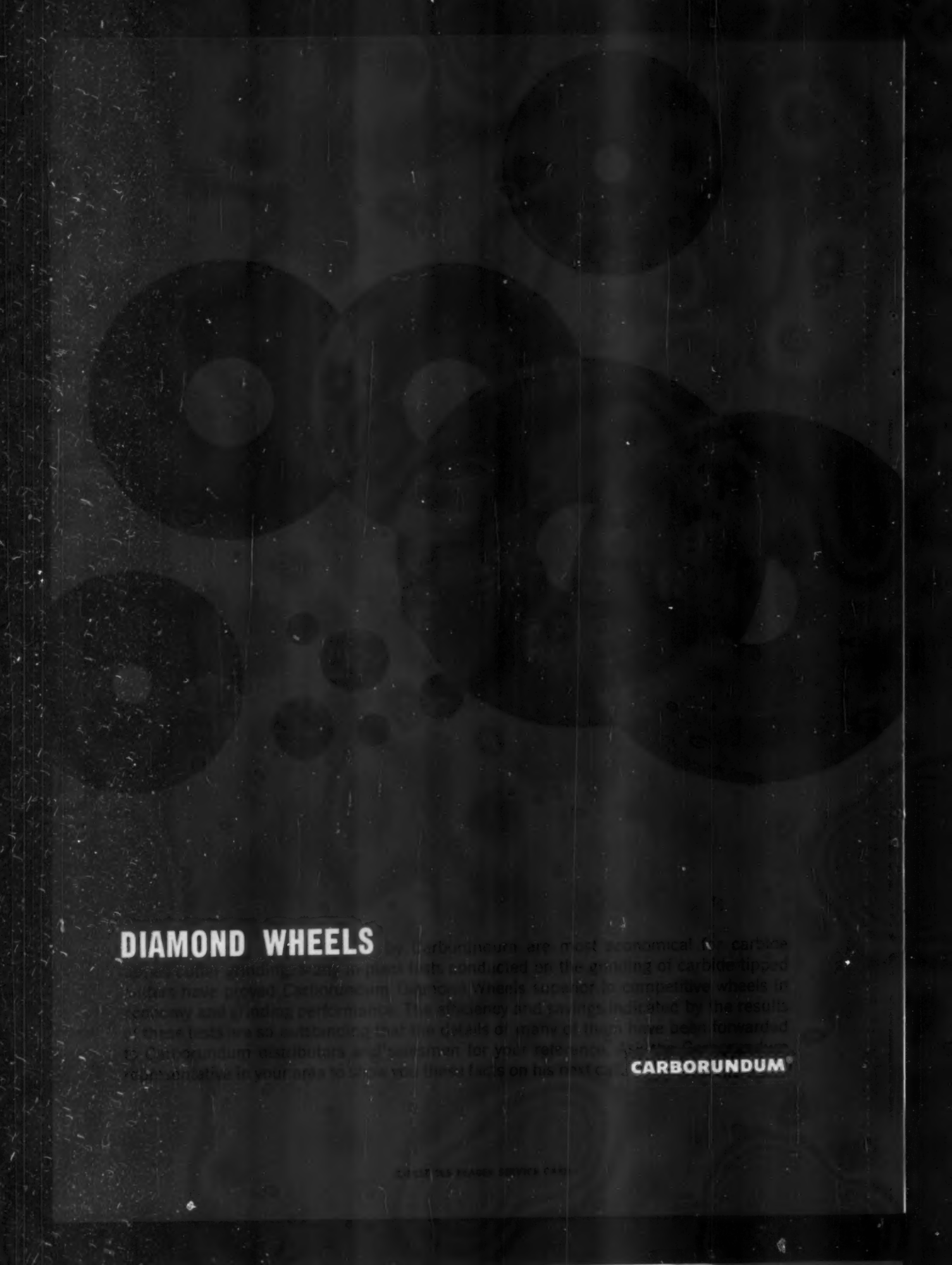
Trouble Chart for Cutoff Tools

Possible Causes	Corrections
Breakage	
Tool too thin for stock; rake excessive; point too weak from excessive angle	Width depends upon size and shape of stock, depth of cutoff and type of cutoff. For cutting off 1 in. round rod, representative tool widths are: 3/64 in. for depth of cut below 0.125 in.; 1/16 in. for 0.125 in. to 0.1875 in.; ⅛ in. for 0.313 in. to 0.500 in.
Length Tolerance Not Held	
Tool too thin; point angle wrong; tool dull; side clearance wrong; feed too heavy; tool contacting hex corners; toolslide loose; end play in spindles or work spindle head; pick-up attachment damaged; previous operation causes piece to push back	Determine if deflection is caused by tool being too thin for cut; measure point angle and side clearance; resharpen tool; (note angle recommendations below). Feeds for round stock generally run from about 0.0035 ipr for tools up to 1/16 in. wide, to 0.005 ipr for those 3/16 in. to ¼ in.; feeds for square and hexagonal stock commonly run about 0.0005 in. less. Check for contact at hex corners. Determine if slides, spindles, tool holders have play. Check pick-up attachment for wear or damage. Measure part following preceding operation
Tool Chatter	
Tool too thin for depth of cut or stock size, too much rake; dullness; off center; too much play in spindles; breakdown of hex stock incomplete	Note tool-width recommendations above. Check for rake of 0° to 3° for 2011, 2017, and 2024 and 5° to 10° for most other alloys. Sharpen with front angle of up to 23°, according to machinability of alloy, a front clearance of 8° to 12° and side clearance of from 0° to 4°. Gage for off-center difficulty
Rough Finish	
Dull tool; improperly set tool; point angle too blunt; side clearance too small; rake angle insufficient; tool "hogging in", off center; worn bearings; defective holder; damaged toolslide; heavy feed; coolant insufficient; chips interfering with coolant	Where no forming of the bar or cutoff piece is necessary, other than parting, the thin, straight-type blade is usually employed. An angular cutoff is used when coning or pointing is required. Where chamfering or a similar operation is needed, the circular cutoff tool can be shaped accordingly, and it holds the same contour through repeated sharpenings. The thin-blade type has a square cutting edge at right angles to the centerline of the tool point; this cutting edge may be beveled to about 15° to prevent burrs on the cutoff. Often it is advisable to provide hook for additional rake and chip curling, when cutting softer or more gummy alloys. Holder, toolslide must be rigid. Slacking off feed at end of cut may eliminate burring

Trouble Chart for Tapping

Possible Causes	Corrections
Breakage	
Dull tap, dragging on cut, improper land, wrong cutting angle, wrong number of flutes, wrong type of tap; percentage of thread too high, 75% maximum, 65% preferred	Sharpen to recommended angles (about 10° hook and 10° to 20° rake angle); when radial thread relief is insufficient, dragging is encountered, check angles, relief; select appropriate number of flutes for hole diameter—2 flutes for holes under ¼ in.; 3 flutes for those ¼ to ½ in., 4 flutes for holes over ½ in.

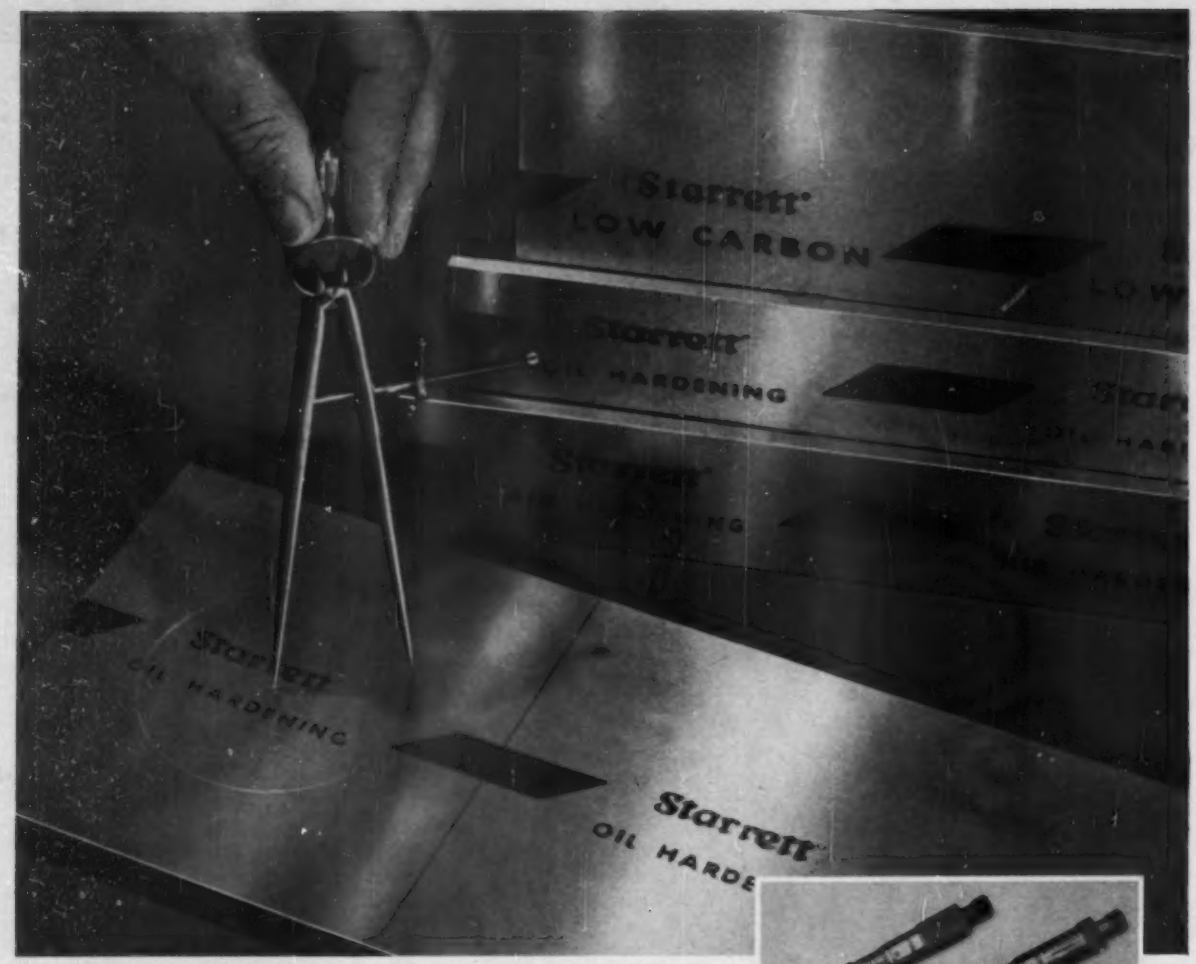
Continued on page 93


DIAMOND WHEELS
CARBORUNDUM®

Screw Machine Work on Aluminum—VI

Trouble Chart for Tapping —*Continued*

Possible Causes	Corrections
	Breakage
Drilled hole too small; hole out of line; inadequate clearance at bottom of hole; tap lead-angle too short	Check size of hole and alignment; if hole is too small, tap may show reaming action. Out-of-line hole will show deep and shallow threads. Provide generous clearance at bottom of hole for all except bottoming taps
Chip clogging; rough tap flutes, poor grinding and polishing; lack of lubricant; speed too slow; work-hardened hole	If alloy is stringy, it may be necessary to use a fluteless or spiral-flute tap. Grinding marks on a tap or roughness can cause clogging; lubricants are essential. Speed in small diameters is more important than for larger ones. If torque is excessive, a 2- or 3-flute tap should be used. If surface of hole has been work-hardened by using too fine a feed or a dull drill, the tap will probably break or the thread will show a poor profile
Tap pushing or dragging on cut	Try more relief, change to more flutes; try different lubricant; grind more hook and rake angle; where threads are torn and rough, fewer (but larger) flutes may be the solution
Miscellaneous causes	Loose bushings or spindles can cause breakage, as can loose threading clutches; tap holder may be wrong type or worn. Speed may be too fast for feed or vice versa. Polished or plated flutes may be necessary if sticking persists. Out-of-round holes produce threads only on two sides
	Rough Threads
Rough or worn tap, dragging on entry; build-up on cutting edges; flutes packing with chips, flute size insufficient; poor alignment; hole too small; eccentric hole; insufficient coolant	If tap is cutting too small as well as rough, more rake often helps. Check chamfer on tap lead—hook and rake angles should include the first full tooth. If excessive heat is causing build-up, provide coolant-type lubricant; try fewer flutes, but larger ones. If hole size is too small, tap has excessive stock to remove, resulting in torn, rough work. Eccentric hole results in much the same condition as too small a hole. If work hardening has occurred in drilling, reaming may be necessary; reaming will also reclaim eccentric holes
	Variation in Pitch Diameter
Worn tap, defective tap, oversize or undersize tap, too much land; insufficient clearance, pushing or dragging; rough first thread; oversized hole	Resharpening without change in form often helps, but added rake is probably better. An undersize tap is more likely to cause pitch-diameter variation; too large a tap causes excessive torque. Relief should be ground on taps with too much land, or a tap with a greater number of flutes substituted. More radial thread relief can alleviate shaving thread on backing out. Insufficient clearance for chamfer can cause tap to "ride", especially where chip buildup has occurred. Lubricant, correct sharpening, with relief on the high side, and correct tap and hole size will generally relieve pushing or dragging of tap
	Tapered Threads
Threads shaved by tap retraction; heat caused by excessive land, poor grind, tapered hole, misalignment	Grind more radial thread relief, polish lands, use more efficient lubricant; change to more flutes if breakage will not be a problem (2- and 3-flute taps are stronger than 4-flute); grind to recommendations; check ID of hole at several points; gage for straightness



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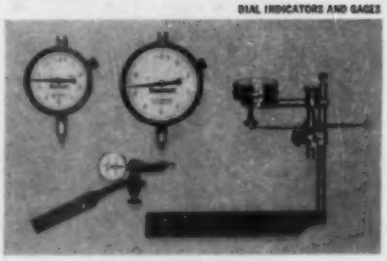


HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES

Talking Shop

Spec Problem

IF YOUR COMPANY is plagued by the problem of specifications that affect your products and are constantly changing and multiplying, you'll be interested in a solution proposed by Dr S W Brossman in *The Magazine of Standards*. He suggests concentrating all specifications in the company library and establishing a small group of engineers there called "Specifications Service" who will be familiar with the current status of specs and publicize the "service" in the company. Maybe, with adequate publicity, everybody in the company will learn to check with these specialists. Maybe they won't and you'll have to change it to "specifications control." But be optimistic and start it as a service. Dr Brossman says it's a lot better than having specs spread all over the company and suddenly finding the company has put itself in a serious and indefensible position because of ignorance.

Long-time Friends

SOME TIME AGO we asked to hear from any readers who felt they had been reading the magazine an unusually long time. The two who seem in contention for the distinction at the moment are Zenas P Candee and Wilbur Chapin Searle. Mr Candee says he has been a subscriber and reader for more than 50 years and he thinks it is nearer 60. Mr Searle says he started his subscription about 1901. If they both seem a trifle vague about the date, it is understandable. We are a little vague about when we started reading the magazine, and it was only about 25 years ago.

We mention these devoted readers because this issue marks the start of our 84th year of publication. Such an odd number deserves little marking, but we must pause to pay tribute to Mr Candee, Mr Searle, and the thousands of readers who have read us for many, many years — though usually a good many less than 60.

Another Champion

UNDOUBTEDLY THE LONGEST and most regular reader of this magazine is Fred Colvin, but as editor emeritus it hardly seems fair to count him. Fred probably looked at the woodcut illustrations in the first issue (he was about nine at the time) and his first published article appeared nine years later. Fred still reads the magazine avidly and comments freely on what he reads. He drops in to see us occasionally when business brings him to town and tells us about the new machines he's seen on a recent trip to the Midwest — or to England.

Abortion

"A TWO-DIMENSIONAL cutting operation was aborted recently, when one motion jammed and the other continued. Result: the cutting tool chewed through the workpiece . . . and then through the table in a kind of automated hara-kiri."

This incident was reported by J H Tolan of Lockheed in a recent SAE paper in which he discussed the development of controls to prevent the machines with automatic controls from meeting such a fate.

One solution would be a radioactive probe that might also control the contour of screwthreads in grinding, measure internal cuts, and wall thicknesses.

Electric Discharge Grows

IN A RECENT LETTER to stockholders, Elox reports on interest in EDM in Europe. There are about eight companies manufacturing machines — two each in England, France, Germany, and Switzerland. These eight companies, says the letter, have sold about 2000 machines. Elox itself has sold about 800. The US company has been making machines much longer, of course, but then few were sold in the early years.

Safety in Automation

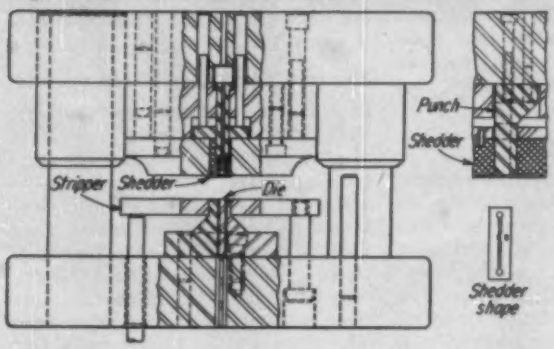
AUTOMATION has substantially reduced safety hazards in plants where it has been adopted, Glenn Griffin of the National Safety Council said recently. One company reported a 60% drop in the accident rate in the four years following automation of engine block operations.

However, on-the-job hazards increase in maintenance work. One hazard is that of lines being shut down and then started up while somebody is working on them. Also the importance of keeping the line running is so great that men will try to make minor repairs and adjustments with machinery running.

"One way to eliminate this," Griffin told a conference at the University of Michigan, "is the good old safety practice of scheduling preventive maintenance." •

Practical Ideas

Epoxy Punch Support Solves Die-Construction Problem



Because of the thickness of the material (0.010-in. brass) in the parts this die produces, clearance tolerance between the punches and the die are held to a minimum. It also follows that, since the piercing punches are, for the most part, only 0.028 in. wide, accurate alignment of the mating components is of utmost importance.

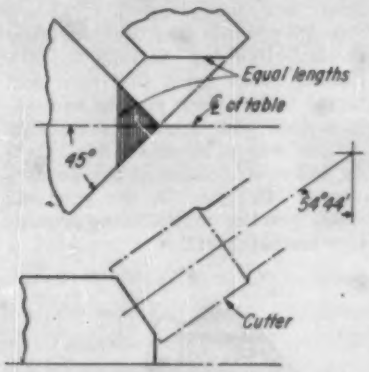
The blanking punch, serving also as the piercing die for the perforations, required special treatment as it was impractical to attempt producing the narrow slits in a solid piece. This was, therefore, made in three sections which, when combined, produced a blank 1½ x 7/16 in. with perforation parts accurately dimensioned and positioned.

Our major problem was in the die assembly which mounts in the top half of the die set and carries the piercing punches backed up by a hardened button. More specifically, the question was how to design and make the shedder for proper support of the slender punches. After considering numerous suggestions, it was decided to make the main body of the shedder poured epoxy.

In preparation for the pouring, four setscrews were threaded into a back-up plate to provide anchorage for the epoxy in addition to its natural adherence to the plate. Then, with all punches aligned and secured, they, and the inside walls of the blanking die, were given a thin film of oil before the epoxy was poured and allowed to harden.

A push-off pin assembly was installed in one corner of the shedder to break the oil seal between the finished part and the shedder. And, four ejector pins were used to actuate the shedder in ejecting the part from the die block and strip it off the piercing punches as the press reached top-dead center. A circular stripper plate stripped the scrap off the blanking punch in the bottom half of the die set.

Cliff Bossman, Dayton, Ohio



Compound-Angle Setting For 45° Chamfers

When removing a corner formed by three faces (90° apart) of a workpiece, it is sometimes desirable to have the resulting angle 45° with each edge making the three chamfers the same lengths. This creates a triangle flat with equal sides.

As a compound angle is involved, the angle necessary for the cutter or the work to obtain this condition becomes 54°44'. If a milling machine with an angular head is used, the head is swiveled to 54°44' from the vertical and the work rotated so both sides are 45° from the centerline of the table as shown.

If a fixed-spindle machine is used, the work is mounted on a sine or angle plate and tilted 54°44' from the table surface. Should the cut be for appearance alone, it is easy to remember that 10° has to be added to the 45° for the setting.

M W Loftus, Chicago, Ill

Grooved Parallel Reduces Drill Breakage

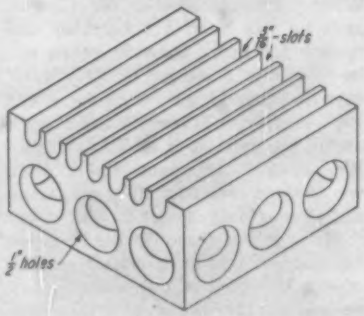
After experiencing difficulty with drilling small holes in small parts, we designed the parallel block shown to remove the major cause of the trouble. This seemed to be in the method of supporting the work at the start and during the operation. A standard parallel, or back-up block, offered too much surface resistance and would not permit the work to align itself. This is required if you drill to centerpunch marks.

The narrow surfaces of ribs, produced by grooving a block, reduce resistance to a minimum. When a drill is brought into contact with a centerpunch mark on the work, the work will, if necessary, shift slightly to center itself under the drill.

Thus aligned, the drill will produce a more accurate hole with a greatly reduced chance of breakage. A point to bear in mind, however, is that the drill must be centered in one of the grooves to avoid spoilage by striking a rib edge.

The parallel shown is 2 in. square by 1 in. high. Seven 3/16 in. grooves are ball-end milled across the top face on 16/64-in. centers. And, to reduce weight, three ½-in. holes pass through the block from adjacent sides. After hardening, the block is ground all over.

Alfred D Farkas, Livingston, NJ



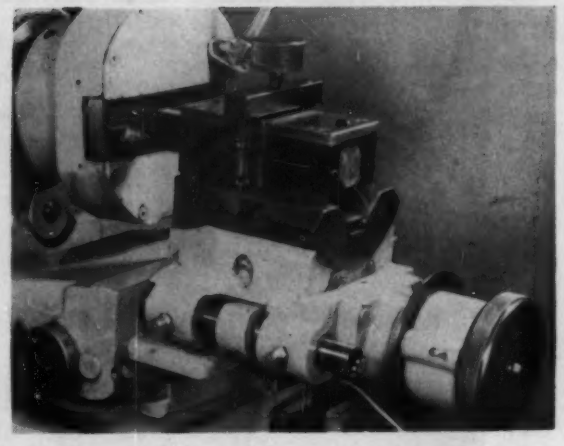
V-Block Adapter Assures Repeat-Setup Accuracy

Our precision tool grinder is well equipped with tool-holding devices with the exception of the area of tools having off-standard shank diameters and shapes. This, to say the least, created a problem when such tools had to be moved to a surface plate or contour projector for inspection. It was then necessary to break the setup with the result that the positioning needed to replace the tool for more stock removal was lost.

As the photo shows, the machine has a toolholder-locating nest controlled by 45° angles that align the work-clamping device on the centerline of the knee column. Taking advantage of this feature, we made a precision V-block that would take bars or tool shanks up to 1 in. dia.

This V-block is an independent unit with its own clamping screws through a cover plate to hold the tool shanks. High precision is attained by grinding its internal V true and parallel with the seating faces to within 0.0002 in. A bridge clamp with a thumb screw holds the block in the locating nest.

We can now grind any tool geometry required on



tools having shanks up to 1 in.; remove the block with the tool and make any inspection necessary, then return the block to the nest for more grinding if needed without loss of accuracy because of positioning.

H W Reed, cutting-tool maker, Ordnance Dept, General Electric Company, Pittsfield, Mass

Flexible Sheet-Stock Locator

We had contructed a progressive die that produced parts having several tabs and one flange formed down. Because of these formations, the stock had to be raised from the die face to allow its progression.

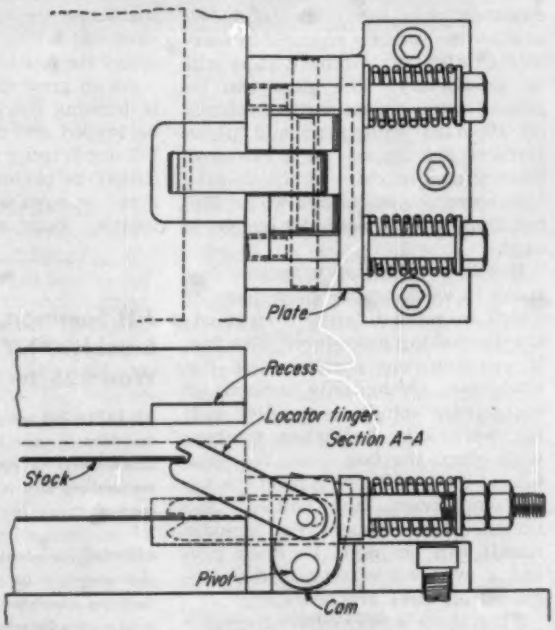
However, we had difficulty in holding consistent dimensions from hole and tab locations to the front edge of the stock because of the necessary minimum clearance of 1/32 in. between the stock and the guides. As long as this clearance exists, any operation performed in the die can fluctuate a like amount from the stock edge.

Our solution to the problem is in the form of a flexible stock locator which, once engaged, follows the stock in its up and down motion. In my particular case, I wanted to control the front edge of the stock so the locator is mounted in the rear of the die between the first two stock lifters.

On the down stroke of the press, the bottom of a recess milled in the stripper plate contacts the locator finger which, at the last instant of closing, pushes the stock tightly against the front stock lifters. In so doing, the location of the stock front edge is controlled as the roots of these lifters are positioned with relation to operations performed in the die.

Small amounts of rework are required on the die and stripper plate to provide working space for the locator finger. On both members, recesses are made liberally wide and long with some clearance in the recess of the die, while the bottom of the stripper recess holds the finger horizontal when the die is closed.

The locator assembly is an independent unit facing the die and bolted to the die shoe. It consists of an angular weldment which carries a cam on either side of the locator finger. The cams pivot on a pin through the base and are backed up by a spring-loaded plate. The force behind the plate is supplied by two com-

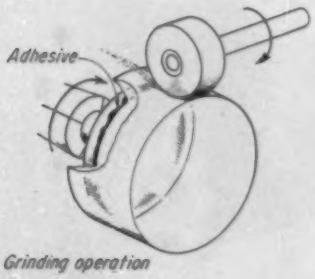


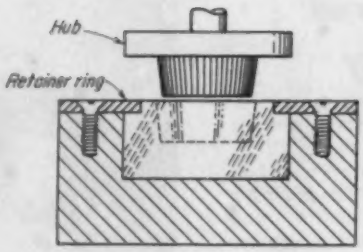
pression springs mounted on studs screwed into the upright portion of the angle. Tension adjustment is provided by two jam nuts on each stud.

In relaxed position, as when the stock is raised from the die, the cams rest against the angle upright. But as the die closes, the cams are pushed back, via the finger, against the compression of the springs. As for heat treating, only the cams and the finger need hardening. Pivot pins are standard dowels.

Gene Maier, design engineer, Presto Manufacturing Company, Jackson, Mississippi

Practical Ideas





Glass Makes Economical Die Inserts

Durable inserts for plastic molds, wax molds, and precision-casting dies can be made accurately in glass. The construction of these mold inserts largely follows some of the same technology employed for steel inserts; that is, hubs and heat are used; but that's where the similarity ends. Thus, the costly process of hand working and polishing is entirely eliminated.

For dies which will be subject to considerable heat variations, heat-resistant glass should be used, but at other times as, for example in wax-molded dies, any ordinary glass will be satisfactory. The glass can be ground with silicon-carbide wheels on standard equipment and plane surfaces are lapped on a cast-iron plate with a mixture of silicon-carbide abrasive powder and water. For polishing, aluminum-oxide rouge is used.

It will be necessary to learn a few tricks in working the glass, some of which are quite different from standard die-making procedures. The first is grinding the periphery of the workpiece. Customarily, the axis of the grinder spindle is parallel with the work axis, but when working with glass, the two cross the rotation of the wheel, being from the top surface towards the bottom. See sketch. And, though high spindle speeds can be used, low feed rate and slower work rotation than required on steel are necessary.

Then there is the matter of mounting the work for grinding. We do this by attaching the glass to the trued end of a bar or pad gripped in the lathe or grinder chuck. The bonding media is an adhesive composed of 42% coal-tar pitch, 25% pine resin, and 33% shoemaker's pitch. For working either of the plane faces in the surface grinder, the work is fixed to a steel plate to be held on the magnetic chuck.

Now for the preparations before the actual hubbing. A hub is made in the usual manner except that it need only to be as long as the required cavity depth. And, if the hub is flanged to cover the entire insert, little has to be done to finish the insert's top face. A flawlessly finished hub is a must, and possibly hard-chrome plated, to prevent scoring the glass. After the insert has been ground to a slip fit in the die block, (no need for allowances because of shrinkage being practically non-existent) a ring is bored to take the insert for heating.

As no great pressure is necessary in forming the cavity, the hub may be tapped down with a hammer to full depth using proper guidance. But it may be preferred to use an arbor press, or even a drill press, because locating stops can be prearranged. Once preparations are made, the glass with its retainer ring and the hub are heated.

Ordinary glass is heated to 450-500C (840-930F) and heat resistant glass to 750-800C (1380-1470F). With some experience, the readiness of the glass, in either case, can be judged by its light red color. The temperature of the hub should be kept fairly near the temperature of the glass at the time of contact. On completion of sinking the cavity, the glass insert and ring are returned to the furnace where the glass is allowed to cool slowly over a period of hours to avoid tension.

The finished insert, properly fitted in the die block, (which means it must not be too tight so it has to be driven in) can be secured in two ways. One way is to cement it in place with synthetic resin, and the other is to retain it with a ring as shown in the sketch.

András Gábor, Budapest, Hungary

Al Paint Seals Gaskets

Instead of using grease, adhesive, or so on when you're installing gaskets, such as on a cylinder head; try spraying the gasket with aluminum paint from a pressure can. You'll get a tight seal that won't squeeze out, but will compress and fill any spaces under the gasket.

H Miller, Philadelphia

J H Sperman, Brooklyn, NY Won $25 for his idea:

Modified Drill Bushings Save Cutting Tools
in the Oct 31, 1960 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

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HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

Louis T Rader

is a pioneer—a somewhat disconcerting label for a healthy, vigorous man just pushing 50. But to the latter-day science of tape control, he is one of the links between ideas and the reality of production. Name the machine tool—drillpress, miller, jig borer, punchpress, lathe—chances are . . .

He's got it taped

In the not-very-ancient lore of numerical control, the little town of Waynesboro, Va, is just as much a shrine as is Cooperstown, N Y, to baseball. Out of General Electric's Specialty Control Department at Waynesboro less than a decade ago came the first punched-tape control for a machine tool.

The story of Waynesboro is the story of Louis T "Doc" Rader, Canadian-born onetime gold mine "mucker," CalTech classmate of Simon Ramo and Dean Wooldridge, and pioneer in welding the infant science of tape control to the teen-age concept of automation.

"People," he tells you, "think automation and tape control are two different things. They're not." This similarity, or tie-in, is in fact the basis of GE's "Flexible Automation" concept, created at Waynesboro while Rader was general manager there—a standard line of packaged numerical controls for individual machines, which are the basis for a continuous-flow, fully automated line with a single data storage medium for warehousing, shipping, inventory records, materials flow, and scheduling.

A towering over-six-footer, Rader gives an impression of bursting vitality. His speech is rapid fire, larded with colorful adjectives—a hangover from his days as a mucker (pick and shovel man) in a remote Canadian gold mine. But even his quickness of speech seems unable to keep up with a rapid turnover of ideas.

His office (he's now vice president in charge of non-military operations for the United States for International Telephone & Telegraph Corp) gives a contradictory impression of busy elegance. Two phones on his big desk ring almost constantly as visitors and associates stream in and out of the spacious, richly paneled and carpeted office, which somehow picks up the air of bustle and excitement of the Wall St financial district and New York Harbor some 33 floors below.

In his new job, Rader still keeps his hand in automation, although it runs somewhat afield from the machine tool industry. Under his direction last fall, the first automated post office in the United States, Project Turnkey at Providence, R I, was completed and put into operation.

About the same time Speed Mail, a method of electronically transmitting letters by facsimile over wires or radio circuits, was successfully demonstrated to the Post Office Department by ITT, with Rader at the helm. Tape again, this time the magnetic variety, plays a big part in the bank automation project ITT is working out with Valley National Bank of Phoenix, Arizona. There, a complex of computers and ingenious check-handling devices will cut a wide swath in tedious accounting and posting operations.

Where it all started

In his 49 years, Rader has really gotten around. He was born in a town with a unique if somewhat unenviable history. A few years before his birth, the town of Frank, Alberta, was buried under a mountain slide and only a baby survived. Land was understandably cheap when his family moved in in 1905.

After attending the university of Alberta for a year ("Coldest place

you ever saw. One time it was 40 below for three weeks"), Rader moved on to the University of British Columbia, graduating in 1933 with a (Canadian) degree of Bachelor of Applied Science in Electrical Engineering. He soon found the truth of the old depression wheeze, "A college degree and a nickel will get you a phone call anywhere."

"Me with a BS degree. I wound up as a gold field mucker, doing things like camping out in the mud, falling logs and building corduroy roads. Then I took a step up in the social scale, got a job as an electrician's helper in another gold mine —they were the only thing booming in those days."

Along about this time, his father got fed up with watching his son throw away a college degree on menial jobs. One day he told Rader, "Here's money for your master's degree. Take it in the States. There's nothing here for you."

Rader settled on CalTech, soon won a "depression scholarship" (room, board and tuition for two years), got his master's and was snapped up by GE. His father's foresight had paid off—Rader was now in a challenging job, the then-young science of machine controls.

By 1945, he had made enough of a name for himself to be offered the chair of Electrical Engineering at Illinois Tech. After two years in which he also served as a consultant to Armour Research Foundation, Rader went back to GE. "I was only 34, too young and didn't know enough to be a teacher, really."

Named head of GE's Specialty Control Department, mother department for all automatic processing (automation had just been born), Rader helped lay the ground work for servomechanisms and controls.

Early tape controls

But even as late as 1954, GE had shipped out nothing more than a few tracer controls. That year, Rader went to Waynesboro as general manager to try something radically new, tape controls for machine tools.

Out of their first researches, in cooperation with Giddings & Lewis, came G & L's Numericord system, and then a system for Onsrud machine tools. Not content with developing the first magnetic tape analog controls, Rader and his associates began to look into the possibilities of punched paper tape for controlling machine tools.

The first such control, for a Wiedemann punchpress, cost $40,000. It was then that GE took a calculated risk, priced the control at $10,000, figuring that sales volume over the long run would justify the price cut. It worked. Burg Tool of Gardena, Calif, alone has since bought more than 100 1D, 2D, 3D, 4D, and 5D controls.

Then came development, in conjunction with Kearney & Trecker, of a control system for the fabulously successful MilwaukeeMatic.

As time went on, Rader and the Waynesboro researchers developed the theory that if simplified tape programming could make a machine tool turn curves and generate circles, computers wouldn't be necessary for most metalworking jobs.

Out of this concept came a standard programming system that works on most types of machine tools—milling machines, drillpresses, jig borers, punchpresses, lathes—which GE has put on the market as "Flexible Automation." It cut down on engineering, which is probably the biggest single cost (30% of sales price) in tape programming.

Tape programming of future

"Tape programming has already been successful with machine tools," Rader says, "and I think it has a future in the whole machinery-making business.

"Look what they're soon to do with tailpipe manufacture. A customer will walk into a shop, tell the clerk what he wants. The clerk puts a tape into a machine, and out comes a tailpipe in just a couple of minutes. There's no reason why this can't be done in bending pipes at a building site, or in the shipbuilding industry. Steel warehouses could do a lot of such work on the spot without carrying such big inventories."

There are too many popular misconceptions about tape controls, Rader thinks. "For one thing, you don't need a large volume to make them pay off. On the contrary, programmed controls pay off best when each lot size is small, even if each piece is different. For example, on a drilling machine all the engineer has to do is dimension on a piece of paper the places where he wants a hole. His secretary can type it up and at the same time make the tape.

"You hear a lot of talk about automation these days. People seem to think it's only for the big auto companies and not for the small shop. That's just not true. Automatic control is here to stay. In fact, American industry is being pushed into flexible automation—that's automatic control applied to standard machines —by sheer necessity because there are so many complex and different models. Tape control is badly needed in the aircraft and missile industry, for example, because there are so many changes in prototypes."

To Rader's way of thinking, tape programming is just a part of automation, and it's a great step forward in cost reduction. Trouble is, he claims, people think tape control is a lot more fancy and expensive than it is, and are inclined to shy away from it even though it is a great cost-cutter.

Automated teaching

Rader's enthusiasm for tape and automation carries over into his spare time and has become an almost unique hobby. "I believe in automation in teaching. You know, teaching machines. Not just closed-circuit TV, but machines that can get the meat out of, say, a biology text, put it into pictures and readable form, and then quiz the students on it.

"Pilot studies have been conducted at our ITT Laboratories, in nearby Nutley (N J), to discover the best approach to programming teaching machines. We've even gone to the Navy to learn their problems in training semi-technical people in physics, acoustics and so forth.

"Of course, we are a long way from production of this type of machine, but it looks as if it will take the form of a series of cards that appear in sequence, each one requiring a response from the student. If he fails to give the correct answer the card is held in view until he works around to the right response. The card keeps appearing again and again, assuring that the piece of information is firmly understood and mastered by the individual."

Rader likes, in his own words, to poke his nose into educational matters, does so frequently in Darien, Conn, where he lives with his wife and his two sons, one of whom attends high school there. His older son is taking metallurgy at North Carolina State.

He has also lectured to PTA's and civic groups and has served on the Governor's Committee on Education in Virgina, where he has a small orchard alongside the Blue Ridge Mountains.

"I get down there once every couple of months. Believe it or not, I raise chestnuts. Thought they were all wiped out by blight over here? They were, but we've got a new kind. Chinese chestnuts. They're blight resistant. I hope to make them pay off commercially one day. Then after I retire I can be one of those Virginia gentleman farmers." •

Frederick Van Norman, one of the founders of the Van Norman Machine Co, Springfield, Mass, celebrated his 98th birthday Dec 13. "Mr Fred" served as board chairman until his formal retirement in 1955. He is a frequent plant visitor to the firm he helped to develop more than 76 years ago

Borg-Warner Corp, Chicago, has appointed **William B Shimer** director of manufacturing services. He was formerly associated with Chrysler Corp as manager of industrial engineering at the Imperial assembly division.

Brown & Sharpe Manufacturing Co, Providence, RI, has appointed **William P Sheffield** director of purchases to succeed **E L Anderson Jr** who has resigned. Mr Sheffield was formerly assistant to the general manager of the Cutting Tool Division.

Brubaker Tool Corp, Millersburg, Pa, has named **A William Tilder** general manager of the **Morton Machine Works Division.** Mr Tilder was formerly vice president and general manager of Acromatic Tool Co of Detroit.

Galland-Henning Manufacturing Co, Milwaukee manufacturer of baling presses, has elected **Hermann A Nunnemacher** president. Formerly executive vice president, he succeeds his father **Henry J Nunnemacher** who has headed the firm since 1917 and will now serve as board chairman

General Motors Corp has appointed **Harold H Miller** general superintendent in charge of Buick engine plant and foundry operations. He is succeeded as foundry superintendent by **Glen W Cline Jr. Donald J Christensen** has been made superintendent of the engine plant to succeed **Raymond L Barton** who has been placed on special assignment on the staff of Buick's manufacturing manager.

Jones & Lamson Machine Co has elected **Holmes H Whitmore** as president and chief executive officer, succeeding **E S French,** who will continue as chairman. Mr Whitmore, recently executive vice president, was vice president and general manager for many years.

Western Automatic Machine Screw Co, Elyria, Ohio has made **Joseph E**

Hydraulic Press Manufacturing Co, Division of Koehring Co, Mount Gilead, Ohio, has promoted **William J Fath** from works manager to director of manufacturing

Ellison factory manager. He will continue to supervise the Moen Faucet and Electric Foundry divisions of which he has been manager.

Fairbanks Whitney Corp has elected **Thomas G Lanphier Jr president of Fairbanks, Morse & Co,** the company's largest manufacturing component. Formerly vice president of Convair, Mr Lanphier joined Fairbanks Whitney last September.

General Precision Inc has named Eric L Sokol production manager for Link Division. He was previously manager of operations at Link's Binghamton, NY, plant.

Stromberg-Carlson has named **W Edwin Boyette** director of manufacturing for the Commercial Products Division, Rochester, NY. Stromberg is a division of General Dynamics.

(Continued on p 125)

Harron, Rickard & McCone Co of Southern California has appointed **John N Heater** (left) sales manager, Machine Tool Division. He will supervise sales activities in the company's three offices in Los Angeles, San Diego, and Phoenix. Mr Heater takes over the duties of **W F Wolf** who was elected president of the firm a year ago

Milford Rivet & Machine Co, Milford, Conn, has elected **Robert M Gordon** executive vice president. He was formerly vice president in charge of sales

Only sheets of steel can endure this annual 50-mile hike

To keep a 100-by-150-foot lawn in trim a power mower churns and chatters more than 50 miles in a single season. A mower needs plenty of strength to stand up under all the hard knocks and vibration!

That's why so many lawnmower parts—handles, housings, decks—are formed from sturdy steel sheets. No cracking, no buckling, no twisting or working loose when parts are made of durable sheets of steel.

So whether your product is a mower or a motor vehicle, you're on solid ground when you design and work with sheet steel. Bethlehem can furnish the sheets you need for the job, in a wide variety of gages, tempers, and surface finishes. And our engineers will be glad to pitch in on your technical problems.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

Steel *for Strength . . . Economy . . . Versatility*

BETHLEHEM STEEL

BETHLEHEM STEEL

Humidifier Prevents Abrasive-Belt Edge Curl

Winter weather and dry atmosphere tend to make the edges of abrasive belts curl or cup where they run free, away from rollers. Behr-Manning has a simple humidifier design, available to any belt users, that can be fabricated in the shop and will prevent edge curl.

The unit is a copper tube, 1¼ in. ID, and as long as the belt is wide, with slots close to each end. Dry steam from the plant system, or from a portable steam generator, is fed to the tube, which direct the steam on both belt edges. The photo illustrates typical edge curl, which was eliminated after the steamer ran a minute.

Tube slot are ⅛ in. wide, 4 in. long, and horizontal, running with the tube axis. Slots are longer for wide belts. Centered inside the large tube is a ⅜-in. copper tube, same length, with a line of 1/16-in. holes drilled on ½-in. centers facing *opposite* the slots. A ⅜-in. fitting admits steam, a tee provides drainage.

Steam will not normally be visible (it should be adjusted for minimum flow that will straighten the belt), nor will it damage the belt or wet the work. Blueprints for the device are available without charge.

Behr - Manning Div, Norton Co, Troy, N Y

MORE DATA? Circle 51, inside back cover

Norton 23 Alundum Abrasive Combines Friability, Durability

Abrasive for wheels and segments combined the friability and free cutting of 32 Alundum with the durability of 56 Alundum in a non-premium material. Field tests show, it is reported, that segments from the new abrasive have longer life with less tendency to burn.

Norton Co, Worcester 6, Mass

MORE DATA? Circle 52, inside back cover

Barrel-Finishing Compounds Improve Tumbling Action

Three new finishing compounds for barrel tumbling include:

101, a concentrated powder for burnishing aluminum, zinc, stainless, and other metals to high luster. As a burnishing material for die castings, it has proven equal to or better than hand-buffed finishes.

101A is a cleaning and burnishing liquid for cleaning, light degreasing, and burnishing, and is recommended for spindle machines, submerged barrels, and vibratory finishing machines. The liquid can also be applied in metal-stamping, cold-rolling, and chain-and-belt lubricants. It may be diluted as much as 75:1.

403 is a neutral abrasive compound, applied with any media, for cut-down of ferrous and non-ferrous metals. It contains a closely screened aluminum-oxide base compound, grease and oil emulsifiers, water softeners, rust inhibitors, and abrasives. It can be applied for self-tumbling or with media to generate radii, improve finishes, and deburr.

Almco, King-Seeley Corp, Albert Lea, Minn

MORE DATA? Circle 53, inside back cover

Spray-On Dry Lubricant Developed For All Types of Surfaces

Slipspray eliminates the mess that often accompanies oil, silicone, and graphite lubricants. Instead of leaving drips, stains, blotches, or sticky spots, it forms a sleek, solid coating that remains dry, clean, and colorless.

Dispensed from an aerosol can, it will lubricate all types of surfaces including metal, paint, rubber, glass, plastic, and leather. It is reported to be unaffected by water, light, oil, or solvents; dries quickly after applications and, under normal conditions, will last for several months. In addition, the product serves as a corrosion retardant for battery terminals, stored tools, and other metal equipment.

Du Pont Co, Wilmington 98, Del

MORE DATA? Circle 54, inside back cover

Wetting Agent for Plating Baths Emulsifies Grease, Aids Draining

Kenvert 15-WA is a liquid wetting agent for cyanide zinc-plating solutions where it is claimed to clean off grease brought in on the parts, and to unplug holes in plating barrels caused by breakdown of plating-solution brighteners. Other claimed advantages include lower surface tension, a light foam in the solution instead of fumes, and decreased salt buildup on anode bars.

The material tends to produce grain refinement and limited brightening—and some parts may be treated with the compound plus bright chromate alone.

The liquid is compatible with practically all brighteners on the market. Price is less than 50¢ per 1000 gallons.

Conversion Chemical Corp, 98 E Main St, Rockville, Conn

MORE DATA? Circle 55, inside back cover

Alkaline Rust Remover Avoids Hydrogen Embrittlement

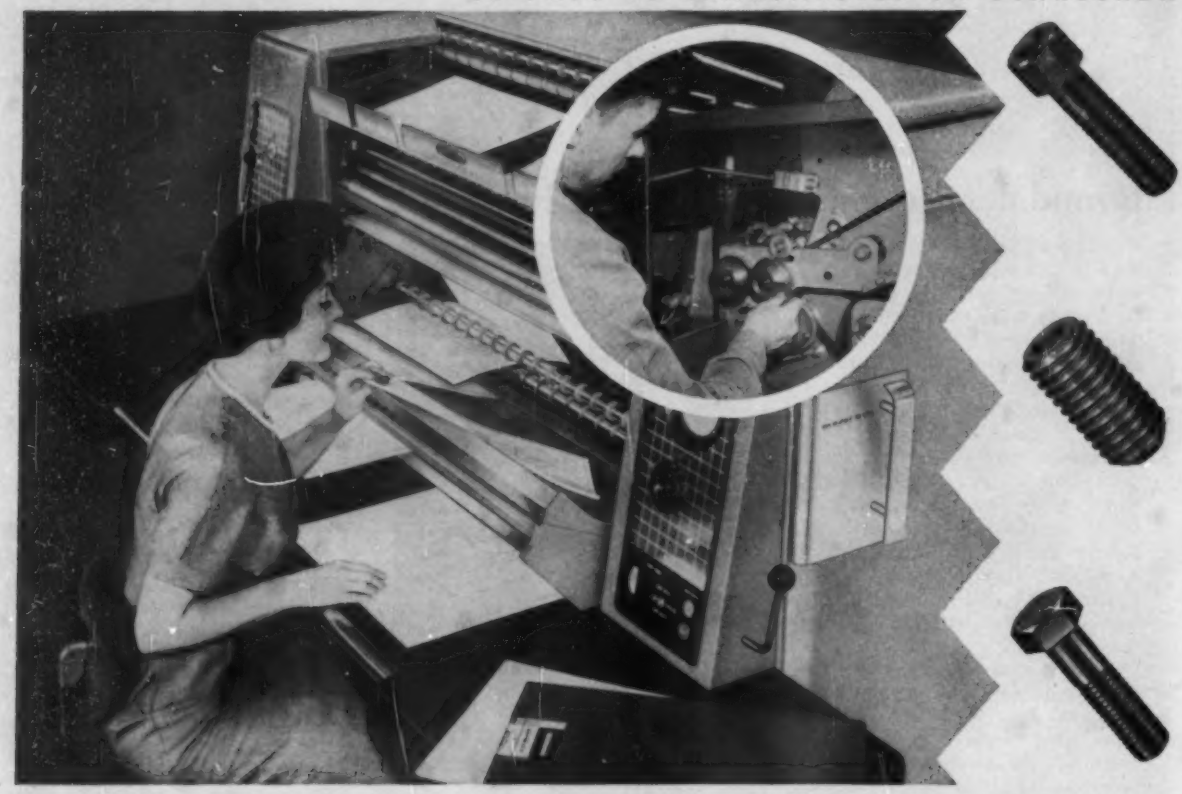
A non-acid, non-rust alkaline rust remover that also takes off carbon and scale, as well as paint, is said to present no danger of hydrogen embrittlement or of dimensional loss. The material works as a one-tank operation, followed by pressure rinse. The chemical contains no cyanide and has no corrosive fumes.

It may be applied in a soak tank or electrolytically in a hot mild-steel tank, welded construction, with a stainless-steel heating element. The liquid minimizes steel darkening and rerusting—no after-neutralization is required.

Turco Products, Inc, 24600 S Main St, Wilmington, Calif •

MORE DATA? Circle 56, inside back cover

IT PAYS TO STANDARDIZE ON STANSCREW



Stanscrew suggests... BRUNING verifies... Socket set screws solve *Copyflex* problem

Charles Bruning, Inc., manufacturers of the widely accepted Copyflex, recently found that the fasteners they were using to attach the unit's sprockets and gears did not meet the rigid performance standards they set up for all component parts.

Bruning's distributor arranged a visit from a Stanscrew specialist, who recommended Stanscrew's regular socket set screws. Bruning verified their operational efficiency with exhaustive laboratory and engineering tests . . . made the conversion . . . and eliminated the loosening problem (plus eliminating many service calls).

Now, 100 Stanscrew fasteners are specified for each Model 675 Copyflex. In addition to socket set screws, they include socket head, hex head, and fillister head cap screws which are used in a wide variety of critical applications.

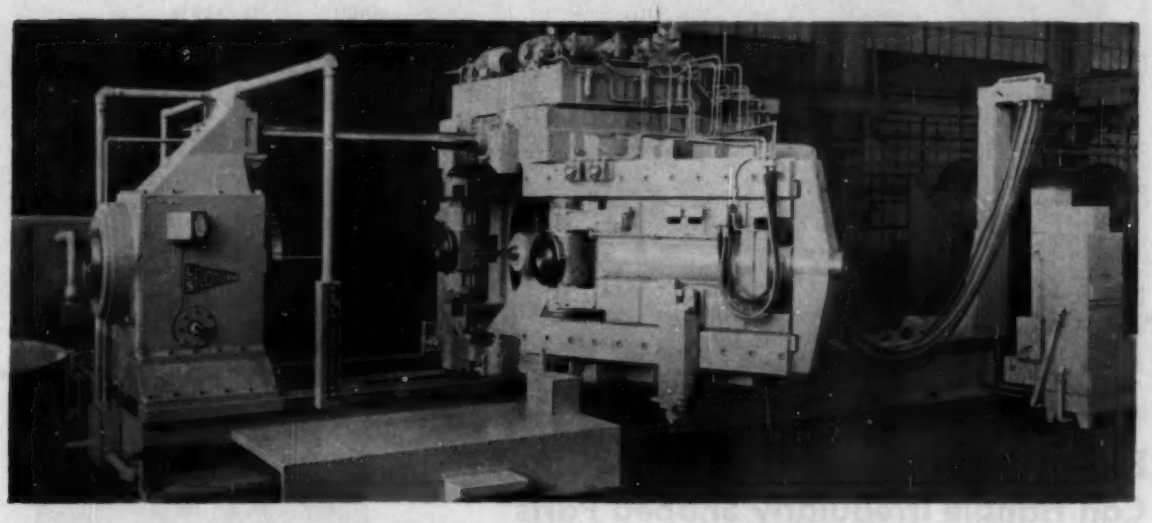
Like Bruning, more and more industrial leaders are learning it pays to standardize on Stanscrew. Their more than 5,500 different standard fasteners provide economical answers to the overwhelming majority of all industrial requirements . . . and are produced to consistent quality standards which eliminate production problems and lower assembly costs.

The Stanscrew fastener specialist may be able to help you cut fastener costs. Your Stanscrew distributor will be happy to arrange a prompt visit. Call him today.

STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois



Horizontal Floturn Shear Forms 70-in.-dia Missile Cases

The No. 70 Horizontal Dual-Roller Floturn will save more than 50% in raw material weight and more than 80% in machining time in the Minuteman program at General Motors' Allison Division. With a price tag of about $245,000, this 190,000-lb giant is designed to shear-form rocket engine cases and nose cones as large as 70 in. dia and 80 in. long. Because the tail stock is removable, cylinders may be back-flowed to lengths above 140 in.

Special features

This is the first L & S Floturn to have two rollers (or tools). Because each of the rollers is capable of 70,000-lb force on the workpiece, a brass or aluminum blank as thick as 1¼-in. can be reduced by 50% in a single pass to form a cone (with a 30° side angle) or a cylinder. Mild steel ¾-in. thick and stainless (300) ⅝-in. thick can also be reduced 50%.

The 47,000-lb machine bed is a single casting, 34 x 7 ft, designed to withstand only the torsional load generated by the rotation of the workpiece, since the retractable feed rods eliminate feed strain on the bed. These retractable rods also simplify loading and unloading of the work. Four hydraulically actuated "stripper fingers," located on the carriage, remove the finished piece from the mandrel. A yieldable tail stock insures a uniform finish on the workpiece.

Time and materials savings

Unded the old process, Minuteman cases were machined down, from forged stock, to tolerances of thousandths. Four cylinders, each 48 in. long, had to be machined, then welded together to form a single section. Under the Floturn process, three cylindrical forgings, only 39 in. long, are elongated or "stretched" to the required length and reduced to the exact wall thickness at the same time. Thus, the only material lost is the burr that must be removed from the end of the workpiece, yet there is one less girth that need be welded.

General description

Spindle drive originates in a 440 v, AC motor-generator (3-phase, 60-cycle). This in turn feeds a 150-hp variable-speed DC drive motor, which has a constant hp range of speeds from 80 to 320 rpm and a constant torque range of speeds from 200 to 400 rpm. Net result: The drive motor will provide from 75 to 150-hp capacity with infinitely adjustable spindle speeds of 40 to 80 rpm.

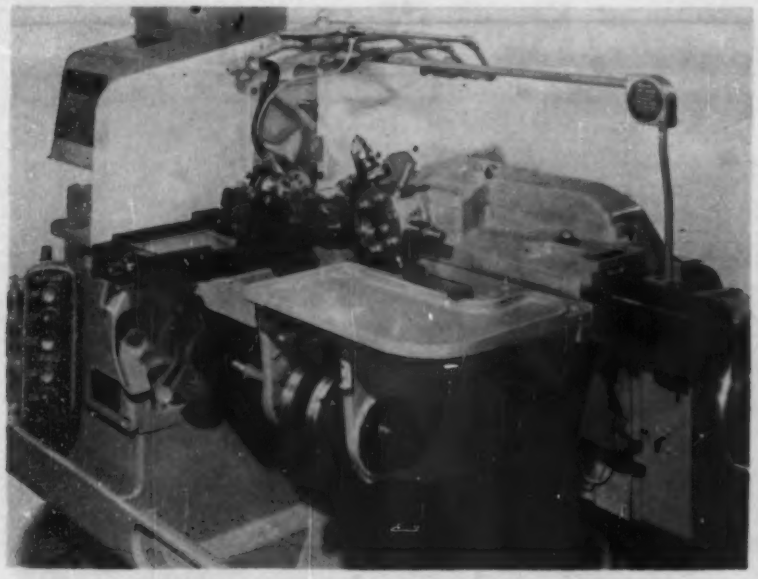
The two 60° forming rollers are swivel mounted in the carriage to allow synchronization of different diameter rollers. Because the tracer heads that control the forming rollers are mounted on individually adjustable slides, the rollers may be offset as well as synchronized. In the offset position, one roller can rough form while the other finishes, or one roller may be removed from the work.

Because each roller is equipped with an over-riding hydraulic motor to bring it up to operating speed before it contacts the workpiece, scuffing and other irregularities are eliminated from the finished surface at the first point of contact. This feature also prevents the roller from being damaged.

Carriage feed stroke is 108 in. at 0 to 30 in. per min normal feed and 0 to 50 in. per min rapid traverse. All moving members are lubricated by forced, metered feed from a 150-gal reservoir in the machine bed. A centralized design is used in the 1500-psi hydraulic system. All hydraulic equipment is mounted on top of the carriage to minimize the flexible hose needed. But, for each machine function, there is a separate hydraulic pump and motor. Pendant controls are provided on each side of the machine.

Lodge & Shipley Co, Floturn Div, Cincinnati, Ohio

MORE DATA? Circle 57, inside back cover



Brown & Sharpe 3-in. Automatic Chucker Can Handle Irregularly Shaped Parts

Because it has a newly designed Skinner air chuck mounted on a spindle specially designed for chucking work, this new No. 2 Automatic Chucking Machine can handle irregularly shaped parts such a forgings, castings, extrusions, and cold-headed parts as well as simple slugs. The chuck, whose jaw movement is 3/32-in. on diameter, has a 3-in. capacity; a 4-in. swing over the cross slides is provided.

A 7½-hp motor supplies power for 15 spindle speeds up to 2095 rpm for jobs which require spindle reversal; for non-reversing applications, two higher speeds extend the range to 2905 rpm. Machine normally comes with a three-jaw chuck, although a two-jaw chuck is available.

Standard equipment, in addition to six-station turret and two cross slides, includes a spindle brake on neutral for loading purposes. The machine uses the same cams, tools, and toolholders as the No. 2 B&S automatic Screw Machine.

Brown & Sharpe Mfg Co, Providence 1, RI

MORE DATA? Circle 58, inside back cover

Ultrasonic Foil Welder Seals Without Deforming

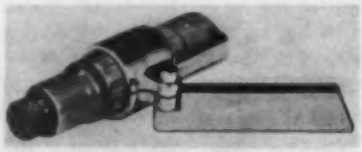
Metal foils 0.000,250 to 0.002 in. thick can be welded with high-frequency vibration by a 10-watt Glennite ultrasonic welder. The unit works without heat and without distorting the material, and is said to produce joints and seams stronger than the parent metal.

Applications include joining gold leads to gold-plated semiconductor materials, and gold, silver, and aluminum leads to germanium, silicon, and ferrite. The unit will also join paladium, copper, quartz, and tellurides—or polyester films.

The machine is mounted on a trunnion base and operates pneumatically. Equipment includes a microsecond timer, binocular microscope, and other accessories.

Vibro-Ceramics Sales, Gulton Industries, Inc, 212 Durham Ave, Metuchen, N J

MORE DATA? Circle 59, inside back cover



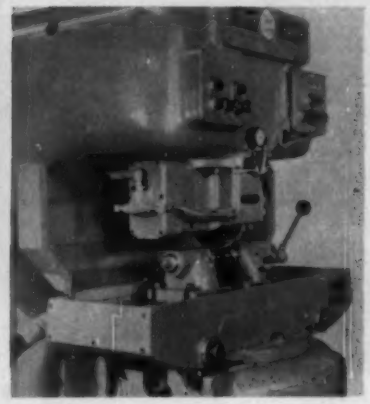
Swivel-Arm Toolholder Speeds Air Tool Mounting on Lathes

Toolholder permits quick mounting of Dotco air tools on any lathe, providing a wide range of work positions without changing the holder in the toolpost. It is designed with a ¼-in. socket-head cap screw. The operator can swivel the air tool through a 180° arc and can lock the tool rigidly in one position.

Available in two sizes for Dotco Series 1 and Series 2 tools, this holder permits the use of high-speed Dotco air grinders and sanders directly on the lathe. Only requirement is that the air tool be equipped with a push-pull sleeve valve to control its air supply.

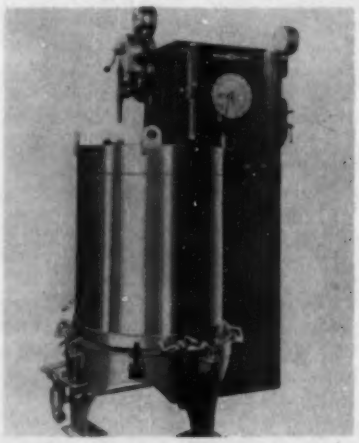
Doeden Tool Corp, Hicksville, Ohio 20

MORE DATA? Circle 60, inside back cover



CUTTER HEAD OF NEW DESIGN, on Red Ring Model GCU gear shavers, finishes tooth surfaces on spur and helical gears up to 18-in. pitch dia—*National Broach and Machine Co, 5600 St Jean Ave, Detroit 13, Mich*

MORE DATA? Circle 61, inside back cover



Hayes Offers Atmosphere Furnace For Bright Tempering of Stainless

Type OLB Series Bell-Temp furnace is designed especially for bright tempering of stainless steels and other heat treating applications calling for rapid cycling and precise control of both temperature and protective atmosphere.

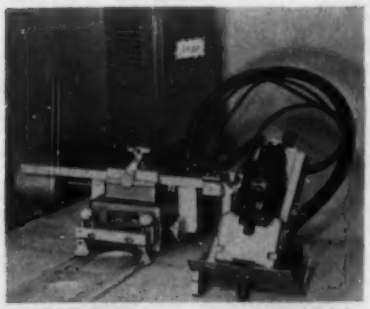
Features include a full length bell-type insulating outer shell that pro-

vides efficient heat retention for economical power utilization. Within the outer shell is a sealed retort which encloses work load, heating elements, baffles, and forced convection fan. Extremely fast heat-up and uniform distribution are assured by high-velocity, 100% convection circulation of atmosphere throughout the workload. Fast cooldown is effected by lifting the outer shell, without disturbing the atmosphere seal of the inner retort, thus exposing the inner retort to room air during the cooling cycle.

These furnaces are available either separately or as a complete package with instruments and controls for precise temperature uniformity from 250 to 1250 F. Atmosphere generators and control equipment may also be included in the package. Standard models handle work baskets 13 in. in diameter by 17 in. deep or 17 by 24.

C I Hayes Inc, 810 Wellington Ave, Cranston 10, RI

MORE DATA? Circle 62, iside back cover



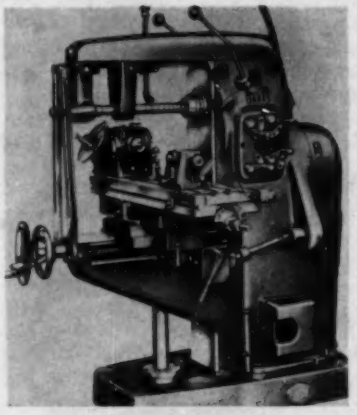
Heavy-Duty Arcair Torch Uses ¼ to ⅝-in.-dia Electrodes

Model Q-5 is designed to automatically groove seams and prepare the edges of heavy plate for welding. It permits production of U groove plate preparation by butting square edged plates together and producing the U groove in two plates in one operation. Complete unit consists of a tractor-driven automatic head featuring all-position adjustment of electrode angle and variable electrode feed. An Arcair contactor with remote control switch is also included to provide maximum safety.

In addition to handling larger electrodes than the Model Q-3, the torch head is equipped with an improved heavy-duty floating device to maintain a constant distance from the work surface. This feature produces a constant width and depth groove in warped plates or out-of-round vessels. The guide wheel on this mechanism is provided with a pivot to facilitate lateral movement. The torch is designed to operate on an air pressure of 80 to 100 psi.

Arcair Co, PO Box 431, Lancaster, Ohio.

MORE DATA? Circle 63, iside back cover



Pedersen Milling Machine Offered With Power Rapid Traverse

Model VPU-1 is now available with power rapid traverse. All Pedersen millers are of rigid construction. The powerful milling spindle is made of special steel. Table is available in special large sizes. Complete line of additional accessories that can be furnished include universal dividing heads, rack milling attachment, rack vise, and circular milling attachment.

Dist by Aaron Machinery Co, 45 Crosby St, New York 12, NY

MORE DATA? Circle 64, inside back cover

Changeable Inserts, on Press Brake Die, Give 0—⅜-in. Radii

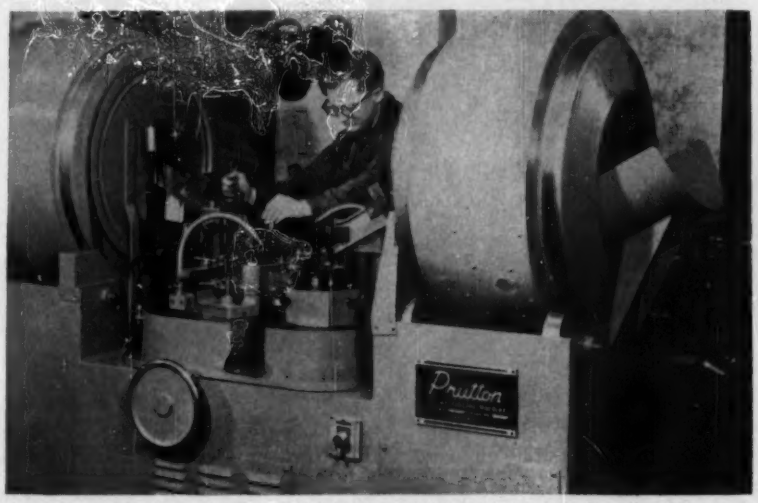
New upper press brake die, called Di-Acro Snap-Form, gives radius bends from zero (square) to ⅜-in. in the same unit by simply changing a radius insert. Ten inserts are provided with each die.

One insert can be indexed to provide a zero radius as well as 1/32 in., 1/16 in., and 3/32-in. radii. Nine additional inserts provide one radius each. Dies are available in lengths from 6 in. to 12 ft.

Designed for use on standard press brakes and punch presses, the Snap-Form dies are said to be particularly useful where a variety of forming production jobs are run or quick die change is required for experimental forming. On shorter dies it takes less than 10 sec to change from one radius to another; less than a minute is needed on long lengths.

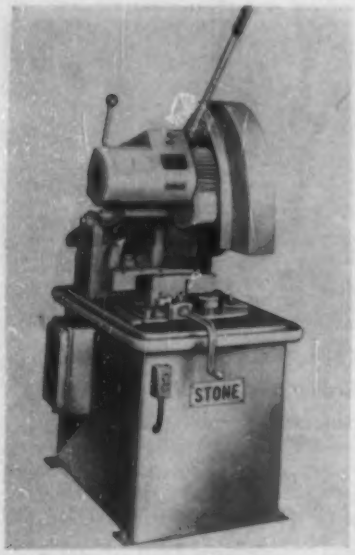
O'Neil-Irwin Mfg Co, 412 Eighth Ave, Lake City, Minn

MORE DATA? Circel 65, inside back cover



MODEL 125A-36 PLANETARY THREAD ROLLING MACHINE handles blanks 8 in. long and up to 5/16-in. dia. Machine shown, which will thread 7-in.-long parts, has a production speed of 200 pc a min—*Prutton Corp, 5305 W 130th St, Cleveland 30, Ohio*

MORE DATA? Circle 66, inside back cover



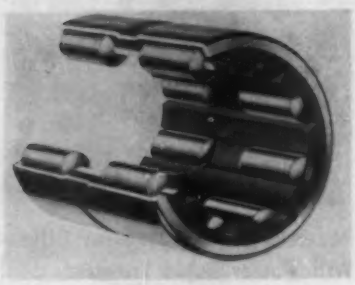
Cutoff Saw Slices Metal at Rate Of 4 Seconds per Square Inch

Model M-120 is designed for heavy-duty ferrous and non-ferrous cutting in toolrooms and on production lines. Powered by a full 10-hp continuous-duty TEFC ball bearing induction motor, the unit's 20-in. blade will cut 4-in. ferrous solids and 6-in. structurals and will handle 6-in. solids and 8-in. structurals and extrusions in non-ferrous metals. Cuts are reportedly held to extremely close tolerances with a mill-like finish at the rate of less than four seconds per square inch.

Unit is equipped with a load ammeter and overheating light and features the Stone geared-in-head motor to provide positive power drive to the spindle with constant speed performance. Gear reduction is designed to offer maximum efficiency in both torque and cutting tool performance.

Stone Machinery Co, Manlius, NY

MORE DATA? Circle 67, inside back cover



Precision Caster Bearing Gives Advantages of Roller and Ball

This new precision caster bearing, now being used in all Rapistan casters and wheels with two-inch tread, has a coefficient of friction almost identical to that of the ball bearing. Therefore, this roller bearing approaches the anti-friction advantage of a ball bearing while providing greater load capacity in less radial space.

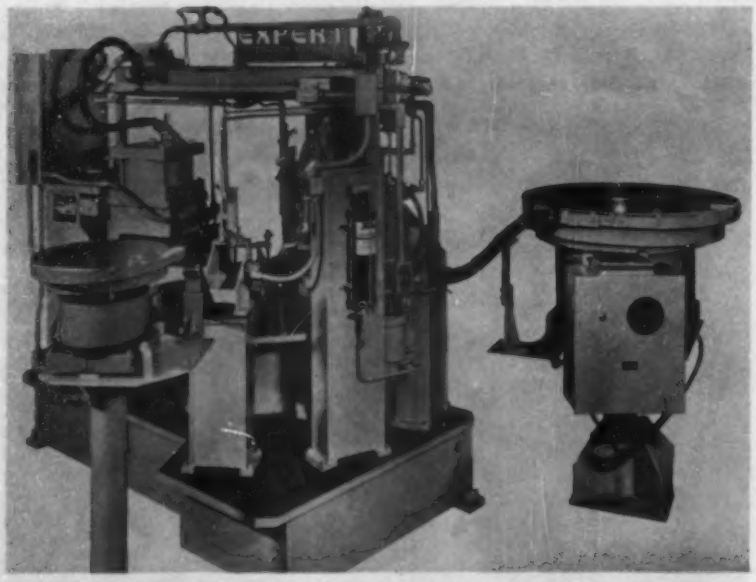
The retainer-type bearing has a drawn cup construction for its case-hardened outter race. Double paths of rollers are retained in non-metallic cages and are lubricated by a lithium-based (non-oxidizing) grease. Lubricant retention is aided by labyrinth construction of retaining cages and lips at either end of outer race. Inner race is hardened and polished.

Because of the lower coefficient of friction, the anti-skewing effect of the retainer cages, and greater lubricant retention, it is anticipated that life of the new unit will average three to four times that experienced with previous bearings.

Because the rollers are ground to within 0.002-in. tolerance, the new assembly qualifies as a precision bearing.

The Rapids-Standard Co, Inc, 342 Rapistan Building, Grand Rapids 2, Mich

MORE DATA? Circle 68, inside back cover



TEN-STATION ROTARY INDEX MACHINE combines assembly, lubrication, and CO_2 shielded arc welding operations to completely fabricate ball joint assemblies. Production rate is 300 assemblies an hr at 80% efficiency—*Expert Welding Machine Co, 17144 Mt Elliott Ave, Detroit 12, Mich*

MORE DATA? Circle 70, inside back cover

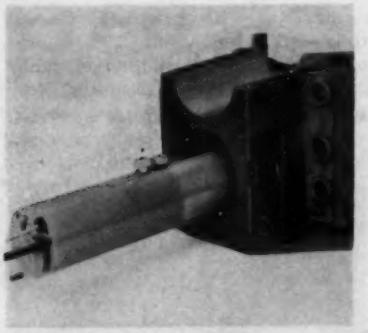
'Snap-Plug' Gage Checks Go, No-Go At One Insertion Into Workpiece

This internal "Snap-Plug" gage, adjustable in the range of 2 to 4 in., checks both go and no-go at one insertion into the workpiece. A simple movement of the wrist upward denotes whether the part is in size or oversize. Gage pins for the cast aluminum frame are interchangeable and replaceable.

A complete kit contains handle, 16 gage pins, micrometer-type centralizing gage, an adjustment wrench, and complete operating instructions. Cost of the kit is said to be less than two conventional double and cylindrical gages.

Southern Gage Co, Erin, Tenn

MORE DATA? Circle 69, inside back cover



Deep-Probe Profile Head Measures Surface Contours

Profilcorder internal linear piloter is a deep-probing head for the Profilcorder surface-measuring instrument, intended for penetrating round, square, or any shaped holes to indicate flatness, waviness, and other surface irregularities. It is interchangeable with linear and rotary heads, all of which will operate with a common Aplicorder instrument.

The new head permits direct readings without damage to the work, which formerly had to be sectioned so an external head could measure surface roughness. Vertical readings can be magnified thousands of times, horizontal readings hundreds of times, depending on the character of the surface being inspected. The unit will operate on metals, glass, and plastic. The instrument records on a 4-in. strip chart with which any surface irregularities can be located and identified, as well as measured.

Micrometrical Mfg Co, 3621 S State Rd, Ann Arbor, Mich

MORE DATA? Circle 71, inside back cover

Tube Bending Mandrel Incorporates New Design

Compound bends to a 1-D centerline bend radius can be made with this mandrel. Ball and socket design enables the ball segments to rotate and to swivel in all directions; ball segments can be removed or added in a matter of minutes without special tools. Set up is less critical and wear surface on balls lasts several times longer because parts are free to rotate. Mandrels are available in tool steel or aluminum bronze in sizes 1 in. and larger.

H & H Engrg Co, PO Box 1096, Englewood, Colo

MORE DATA? Circle 72, inside back cover

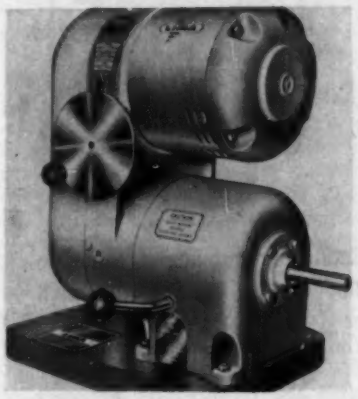
Small Micrometer Checks Internal Grooves

Mini-Mike is a direct-reading instrument that indicates the width of internal grooves and lands in bores as small as ¼ in., particularly in miniature components for hydraulic and fuel systems. Parts can be checked without removing them from the machine.

The unit is said to replace as many as six different conventional measuring devices formerly required to inspect undercuts after machining.

Navan Products, Inc, 900 N Sepulveda, El Segundo, Calif

MORE DATA? Circle 93, inside back cover



Vari-Gear Drive Unit Has Four-Speed Transmission

The Lima Vari-Gear Drive, an infinitely adjustable speed drive, incorporates a four-speed transmission as a component which is claimed to result in three times greater torque at the low speed than in any comparable friction type unit.

Every rpm between 180 and 1800 is obtainable when an 1800-rpm motor is built in. Using a 1200-rpm motor, all speeds between 120 and 1200 are available. Either dripproof or totally enclosed fan-cooled units can be furnished in ½, ¾, or 1 hp. A simple control wheel regulates the output shaft to the desired rpm. A pointer indicates on a calibrated speed plate the exact rpm at which the output shaft is turning.

Lima Electric Motor Co, Dept 132, Lima, Ohio

MORE DATA? Circle 73, inside back cover

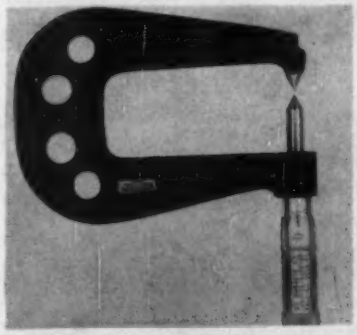
Cavitron Ultrasonic Machine Welds, Solders Tiny Wire Leads

This Universal Ultrasonic Micro-Joiner, which does both heatless welding and fluxless soldering, is said to weld wire leads as fine as 0.0001 in. in diameter. Researchers have welded gold wire as fine as 0.0004-in. dia, and other materials in the range of 0.001 to 0.003-in. diameter or thickness. Any generator suitable for ultrasonic purposes will power the unit.

The kit for micro-joining consists of an ultrasonic transducer hand piece and four basic inserts with additional tips to be added to the line. Initial set of inserts has attachtments for tweezer welds, a ball-modification of tweezer insert, a spot welding insert, and a vibrating table. Wheelhead for seam welding will be optional.

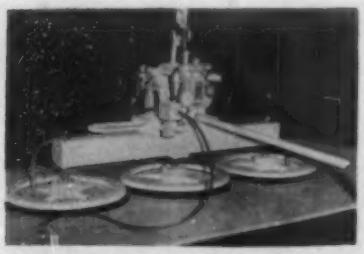
Cavitron Corp, Long Island City, NY

MORE DATA? Circle 74, inside back cover



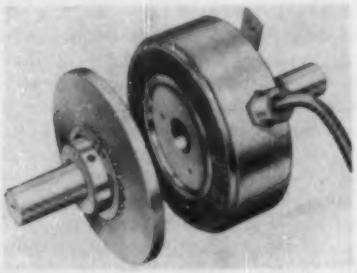
UTILITY MICROMETER measures compound curvatures on airfoil surfaces without error because anvil and spindle are small diameter pointed terminals. Mike has capacity of 0 to 1 in., and 3-in. deep-thorated frame—*JT Slocomb Co, South Glastonbury, Conn*

MORE DATA? Circle 75, inside back cover



VACUUM HOIST ATTACHMENT with capacity of 4200 lb is designed to allow a single operator to lift, transfer, lower, stack, or position any comparatively non-porous material. Self-contained unit with a 110-v single-phase 60-c Vac-U-Lift Powerpac is equipped with three 18-in. pads — *Vac-U-Lift Co, Div of Siegler Corp, Salem, Ill*

MORE DATA? Circle 76, inside back cover



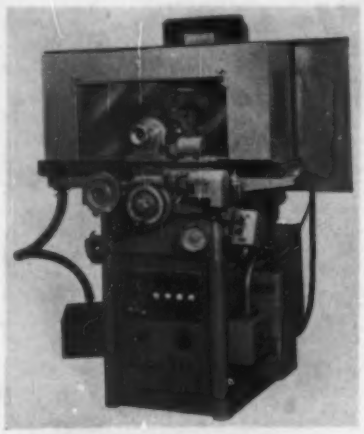
Stationary Magnet Clutch Has Torque Rating of 45 lb-ft

The 5.5 SMR, added to the SMR line of clutches, has a stationary magnet, ball bearing mounted, for ease in assembly and alignment. Coils can be wound for voltages up to 115 v dc maximum and insulated with Class A through Class H insulation. Torque is transmitted through a splined armature to the driven hub. Model can be converted to a magnetically set brake by securing the rotor to the magnet body. The clutch is available in split and through-shaft arrangements.

This unit is also available in clutch-brake combinations (5.5 SMCB). Torque ratings on both clutch and brake are 45 lb-ft and both are magnetically set.

Stearns Electric Corp, 120 N Broadway, Milwaukee, Wis

MORE DATA? Circle 77, inside back cover



Semiconductor Slicing Machine Repeats Within ± 0.0001 Inch

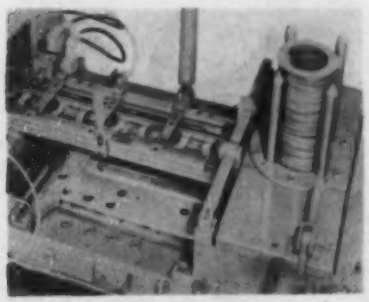
Model 612 machine, which slices silicon or germanium wafers, has a Post PW-4 Decitron Counter which controls the repeatability accuracy of cross feed index to within ± 0.0001 in. The table, driven by a two-speed dc motor, is controlled by full wave rectified ac with dc ripples filtered through an l-c circuit. This is said to assure uniform motion of table.

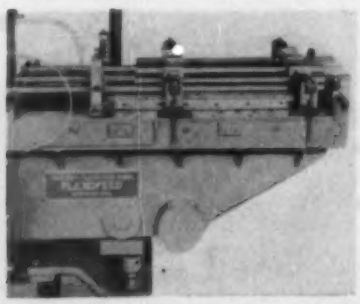
Reid Brothers, Inc, Beverly, Mass

MORE DATA? Circle 78, inside back cover

CALIPER ATTACHMENT allows Sonoray ultrasonic flaw detector to measure thickness of metals and plastics, from one side, to accuracies within ± 0.010 in. It is essentially a fixed, scribed, vertical line, and a second line on a slider, movable across face of cathode ray tube—*Branson Instruments, Inc, 40 Brown House Rd, Stamford, Conn*

MORE DATA? Circle 79, inside back cover





FLEXOFEED PRESS FEEDER has a wide range of feed lengths and speeds, with accuracy down to ± 0.002 in. On some applications, coil stock can be fed at 2500 ipm; blanks as high as 300 per min. When equipped for feeding blanks (as at left), the blankholder is mounted atop the shuttle mechanism; gripper fingers (right) replace blankholder when Flexofeed is set up for handling coil stock—*Precision Welder and Flexopress Corp, Cincinnati, Ohio*

MORE DATA? Circle 80, inside back cover

Milling Spindle-Slide Assembly Designed for Steel Mill Rolls

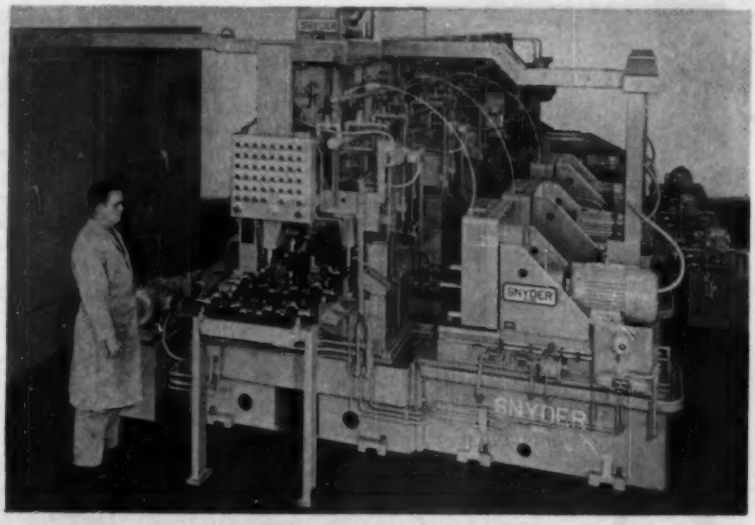
The spindle performs the major cutting operation on a special milling machine for milling the curvature in steel mill rolls while the rolls remain mounted in their respective housings, without dismantling. Rolls are driven and the machining operation is accomplished in one rotation of the roll.

Depths of cut vary from a light finish cut to a maximum of approxi-

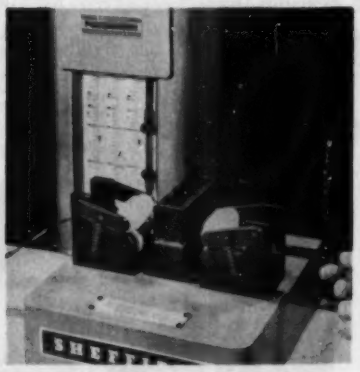
mately 0.125 in. The rols are milled in pairs. The horizontal adjustment, parallel to the spindle centerline, sets the cutter for various roll diameters; the milling cutter diameters are equivalent to the radii of the various roll grooves. This 20-hp motorized assembly has seven speed changes from a minimum of 70 rpm to a maximum of 450 rpm. The slide is equipped with a micrometer dial, gage bars, and vernier scales for setting the milling cutter position. Spindle has a No. 50 NMTB nose.

Standard Electrical Tool Co, 2480 W Sixth St, Cincinnati 4, Ohio

MORE DATA? Circle 81, inside back cover



SPECIAL 20-STATION TRANSFER MACHINE drills, mills, reams, chamfers, taps, and precision-bores automotive engine chankshafts at 78 pieces an hr. The forged steel crankshafts are fed through machining units in five separate sections of the machine by a walking-beam type of transfer mechanism—*Snyder Corp, 3400 E Lafayette, Detroit 7, Mich* MORE DATA? Circle 85, inside back cover



Continuous-Strip Gage Checks 0.0027- to 0.062-in. Stock

Precisionaire non-contact air gage checks strip thickness at three points across the strip as the stock moves continuously through the gage head. The bench fixture has three pairs of opposed airjets, each connected to a separate indicator column, and indicating thickness within 0.0002 in. Gaging amplification is 10,000 to 1, so an inch rise or fall in the column indicates a thickness difference of a tenth of an inch.

Strip stock up to 1 in. wide passes between spring-located Teflon guide rollers that help the gage maintain constant pressure and exact stock position. The thickness range from 0.0027 to 0.062 in. is spanned with riser blocks. Models for other thicknesses and widths are available.

Sheffield Corp, Dayton 1, Ohio

MORE DATA? Circle 82, inside back cover

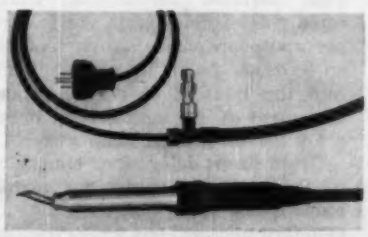
Inch Series Bearings Has Size Range of 3/8 to 5/8-in. OD

Reed Inch Series of class ABEC-7 instrument ball bearings has been added to company's line of miniature bearings. Features include an improved curvature design to achieve stress equalization at inner and outer races for higher capacity; deep groove high shoulder raceways for expanded contact ellipse; and a loose-clinched ribbon retainer providing minimum breakaway torque and freedom from hangup.

Series is completely interchangeable with other makes of similar bearings. Boundary dimensions conform with Standards of the American Ordnance Association.

Reed Instrument Bearing Co, c/o SKF Indusrties Inc, Front St and Erie Ave, Philadelphia 32, Pa

MORE DATA? Circle 83, inside back cover



MODEL 14-HW HAND WELDER AND TACKER for joining thermoplastics is supplied with a 320-w heating element, one round tip, one tacker tip, and a needle valve for airflow control. Unit with 16 ft of neoprene air hose attached, can be plugged into any 115-v ac outlet—*Kamlar Products Co, 932R Washington St, Norwood, Mass*

MORE DATA Ciddle 84, inside back cover

Eutectic Cutting Electrode Operates on AC as Well as DC

This new formulation for the Eutec-Chamfer-Trode metal-cutting electrode permits its use with ac as well as dc welders. Operation is within the same amperage range for ac or dc, and the electrode can be brought to the work rather than bringing the work to where dc is available.

Applications include chamfering, beveling, grooving, in preparation for welding; making fast inexpensive rough cuts to be finished on machine tools for keyways and similar work; and removal of hard-surfacing or frozen bushings.

Eutectic Welding Alloys Corp, 40-40 172nd St, Flushing 58, NY

MORE DATA? Circle 86, inside back cover

High Pressure Parts Washer Can Be Used by Unskilled Labor

Spray-Kleener, designed to clean greasy, dirty parts of all kinds, has an outside manually controlled turntable which will support 2000 lb. It has two guns, one for solvent and one for compressed air. Solvent is constantly strained and re-used while fumes are exhausted to outside.

According to the manufacturer, the washer is safe, economical, fast, always ready for instant use, can be used by unskilled labor, presents no health hazard, and prevents backsplash into operator's face.

Flinchbaugh Electric Co, 745 Water St, Port Huron, Mich

MORE DATA? Circle 87, inside back cover

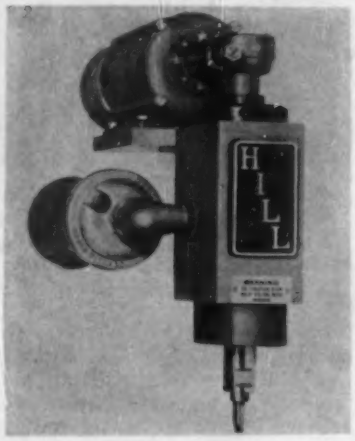
Hopper Elevator Simplifies Loading of Parts

Unit designed to facilitate the loading of parts into the bowls of Syntron vibrating parts feeders can also be used for loading purposes in conjunction with any automatic or semi-automatic parts processing system. A Syntron electromagnetic vibrator keeps the parts moving freely out of the hopper and over the chute. There are no belts, clutches, or other moving wearing parts.

Elevators are available with four hopper sizes, 3, 5, 7, or 10 cu-ft capacities, with supporting structure any height in the 10 to 20-ft range.

Syntron Co, 311 Lexington Ave, Homer City, Pa

MORE DATA? Circle 88, inside back cover



RIVETER HEAD, spin-impact peening type, is available as a separate unit. It can be mounted vertically, horizontally, or at an angle (but not inverted) on a column, pedestal, or panel, or made part of a special-purpose machine tool assembly—*Hill Machine Co, Rockford, Ill*

MORE DATA? Circle 89, inside back cover

Micrographex Comparator Checks Grain Size in Copper and Alloys

This portable instrument, which rapidly determines grain size in copper and copper-base alloys, features an external reflecting element built into the housing to assure proper alignment of the microscope. It has a 4 x 3¼-in. ground glass screen.

Grain size is determined simply by mounting the specimen on microscope stage and then rotating the standard micrographs which are turret-mounted on either side of viewing screen. Twelve ASTM Standard micrographs represent sizes of 0.015 to 2.00 and identify a specimen as being between or the same as the standards. Instrument has standard magnifications of 75, 100, and 150X.

General Scientific Equipment Co, 3055 Dixwell Ave, Hamden 18, Conn

MORE DATA? Circle 90, inside back cover

Semco Press Brakes Offered By Aaron Machinery

These presses have ball and roller bearings throughout except for alloy bronze bearings on the eccentric shaft. The extra size flywheel, ball bearing type, is perfectly balanced.

Dist by Aaron Machinery Co, 45 Crosby St, New York 12, NY

MORE DATA? Circle 91, inside back cover

Micro-Wire Welding Package Offered in Portable Model

Compact, constant voltage motor generator welder rated 200 amp at 25 v and designed especially for automatic welding, makes it possible for Hobart to offer its Micro-Wire welding process in a portable package.

Model 1259 unit includes a 200-amp constant voltage welder with ammeter and voltmeter, wire feed unit, Micro gun and cable assembly, gas regulator and flowmeter with hose and argon adapter fitting, all on a portable mounting with space for carrying two cylinders of gas. Any and all items making up the package may be ordered separately to meet individual requirements.

Hobart Brothers Co, Troy, Ohio

MORE DATA? Circle 92, inside back cover

Fisher Body Spreads in Ohio

A 17% expansion that'll add 214,000 sq ft of floor space at an estimated cost of $10 million is slated at GM's Fisher Body stamping plant in Hamilton, Ohio. Construction will be completed by fall of 1961 and new facilities are expected to call for an increase in employment above the present 3100.

Porter-Cable Acquired by Rockwell

Stockholders of Porter-Cable Machine Co, Syracuse, N Y, manufacturer of portable electric power tools, have OK'd acquisition by Rockwell Manufacturing Co, Pittsburgh. Agreement provides for the acquisition of the assets on the basis of seven shares of Rockwell stock for every ten shares of Porter-Cable. The company will operate as a wholly-owned subsidiary of Rockwell, which makes a complete line of stationary power tools.

$70.1 Million Order to Grumman

Navy has awarded a contract to Grumman Aircraft Engineering Corp for additional production of A2F-1 Intruder low-level attack bombers. The Bethpage, Long Island, N Y, firm has previously received contracts totaling $157.5 million for research and development and initial production of the two-man, twin-jet aircraft designed to deliver nuclear or conventional weapons. First Intruders are scheduled to go into operation on carriers early next year.

Dake Acquires Press Line

Dake Corp of Grand Haven, Mich, has purchased the Automold press line from Automold Co, a subsidiary of Wagner Brothers Inc of West Los Angeles, Calif. Dake manufactures a complete line of arbor and hydraulic shop presses. Automold produces automatic compression molding presses used widely in the plastics industry to form small parts from thermosetting materials. The entire operation will be moved to Dake's Grand Haven manufacturing plant and the press line will be marketed under the tradename Dake Automold.

Power transistors are sealed automatically in a closely controlled environment to prevent contamination by moisture and dust. The Plexiglas dry-box, built by Air Control, Inc, Narberth, Pa, surrounds a Model HA-15 Denison Multipress. Press, with its 12-station index table, turns out from 20 to 70 pieces per minute for one of the largest manufacturers of power transistors. Moisture content is analyzed by the Consolidated Electrodynamics Corp Moisture Monitor on top of the box

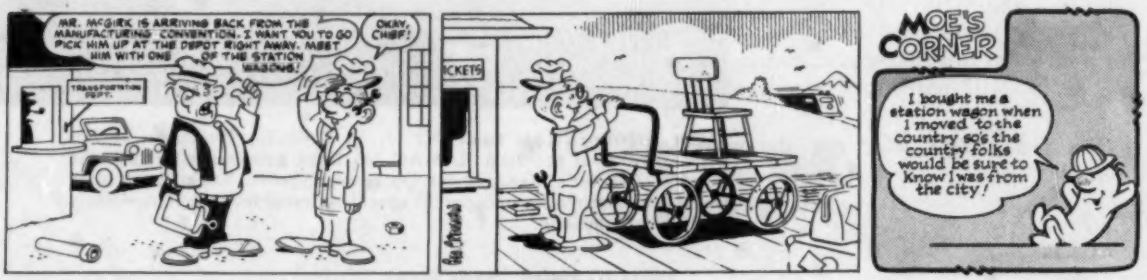
Bendix Buys Electronics Firm

Bendix Corp has entered into a contract with Micrometrical Manufacturing Co, Ann Arbor, Mich, to purchase its assets for cash. Purchase of the company, which manufactures electronic-mechanical units and equipment used to measure the surface finish of various types of materials, fits into Bendix's continuing expansion in the industrial measurement instrument and tape-control manufacturing field. In recent years it has acquired the Sheffield Corp and the Cleveland Instrument Co, and has established an Industrial Controls Section. This most recent acquisition will continue to be operated as the Micrometrical Manufacturing Co and as a subsidiary of Bendix Corp.

(Continued on p 116)

McGIRK'S WORKS

by GEO. CRENSHAW


MR. McGIRK IS ARRIVING BACK FROM THE MANUFACTURING CONVENTION. I WANT YOU TO GO PICK HIM UP AT THE DEPOT RIGHT AWAY. MEET HIM WITH ONE OF THE STATION WAGONS!
OKAY, CHIEF!
TRANSPORTATION DEPT.
TICKETS
MOE'S CORNER
I bought me a station wagon when I moved to the country so's the country folks would be sure to know I was from the city!

Remote unit reports progress
Located in the Sales Department, this remote inquiry station has a direct line to the RAMAC unit on the floor below. When a customer order number is keyed into this station, an up-to-date status report is *immediately* printed out on the automatic typewriter.

Keeps an eye on production
Final assembly and testing of these Cramer timing controls are typical of the many precision operations carried on in the plant. Each involves a large number of small parts which are produced, stocked and assembled under MOS control.

IBM®

Gets information fast—Mr. J. T. Kennedy, Treasurer, checks with operator of the IBM RAMAC 305 Data Processing System—the heart of Cramer's Management Operating System. Disk file at rear stores and continually updates all operating records—each immediately available on demand.

CIRCLE 211 READER SERVICE CARD

Management Operating System at Cramer Controls Corporation

...improves delivery and reduces inventory
...with an increase in sales of 60%

Cramer Controls Corporation, Centerbrook, Connecticut, manufactures precision timers and control instruments. They consider their IBM Management Operating System a *highly profitable investment.*

To this progressive company, with 330 employees and annual sales of around $4 million, IBM data processing is an essential part of management control. It has helped them cut costs...reduce inventories... improve profit margins...speed customer service. And it has done all this while handling a 60 per cent increase in sales and reducing delivery time by five full days.

Built around the IBM RAMAC® 305, the system at Cramer uses modern data processing techniques to *inter-relate* the six major control functions: Sales Forecasting, Materials Planning, Inventory Management, Plant Scheduling, Work Dispatching & Operations Evaluation.

How MOS works to cut costs

Complete data for each major operating function is stored in your data processing system. There, past and present sales trends and forecasts are combined to produce a more complete "finished product" plan which automatically...

- determines material requirements
- checks these requirements against inventories
- allocates stocks to assembly needs
- polices inventories for under- or over-stocked items
- initiates stock-replenishing orders as needed

The sequence continues through scheduling, dispatching and operations evaluation. Continually updated cost and performance figures keep management informed of every phase of production.

Any change entered into the system is automatically reflected in all other control data. The compensation is made according to a prearranged plan—*your* plan—so that all controls are working toward your *current* objectives.

MOS offers comprehensive control

Only with the total approach provided by MOS can you get such coordinated effort, such complete information, such tight operational control. Only with MOS can you study, *in advance* the effect of decisions yet to be made. For more information, call your local IBM office.

IBM® DATA PROCESSING

WITH THE MADISON microller® BURNISHING TOOL, YOU GET A FINE FINISH – FAST!

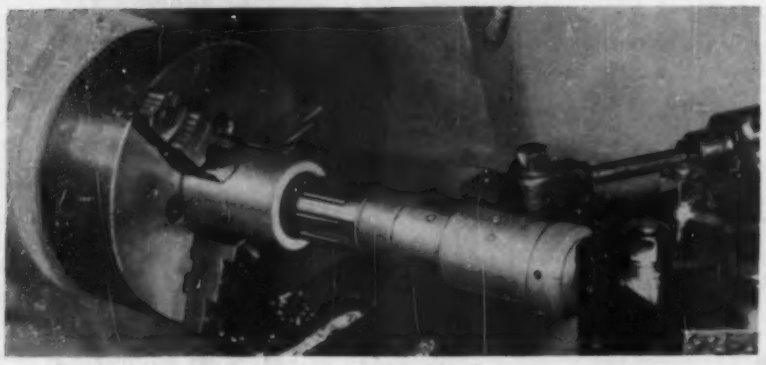
This revolutionary tool finishes rough bored or turned surfaces, of 125 mu. and higher, to 5 mu. and lower at feed rates of 8 to 12 inches per minute.

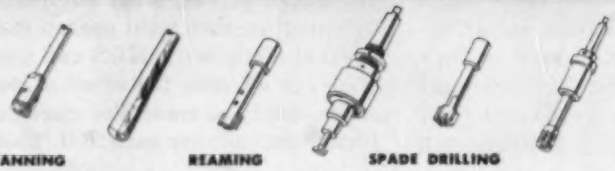
Over 1000 major metalworking companies are continually replacing grinding, honing and lapping operations with the Madison Microller.

Here's why:

- The Microller gives you, in one pass, a finish far superior to any that can be produced with abrasive processes
- You run thousands of parts without tool wear
- No operating skill required
- Can be used in any standard shop equipment
- Finishes any machineable metal—creates a condensed, compacted surface

For additional information, call your Madison representative, or write for our latest bulletin.





MADISON Industries, Inc.
P. O. BOX 1137, PROVIDENCE, RHODE ISLAND

FIELD REPORT

$65 Million Order to Hughes

Three contracts totaling $65 million have been awarded to Hughes Aircraft Co for production of the latest versions of Falcon air-to-air missiles. Work will be carried out at the company's missile manufacturing division at Tucson which employs 4000.

Republic Plans Big Expansion Of Tape-Operated Production Line

Republic Aviation Corp has scheduled a $3 million expansion of its battery of tape-controlled automatic machine tools. Ten additional tape-operated machines will be added to the production line currently building the automatic, all-weather F-105D fighter-bomber, making this one of the largest tape-regulated machining operations in one location in the country. With the addition, there will be fifteen of these machines engaged, representing an investment in excess of $5 million.

Fenn Licenses Japanese Firm

Fenn Manufacturing Co, Newington, Conn, has licensed Komatsu Manufacturing Co Ltd to build and market the Fenn line of rolling mills and related metal forming equipment (plus any new machinery developed by Fenn) in Japan and adjacent Asiatic areas. Komatsu is one of Japan's largest machinery manufacturers, operating nine plants and employing over 7000 workers. Main offices are in Tokyo.

Alco on the Upturn

Alco Products Inc, Albany, NY, has received a $50 million contract from the government of India. The company is also re-opening its locomotive production shops in Schenectady to rebuild 20 locomotives for a major western railroad. The shops were recently closed down and 650 workers idled by a temporary lag in business.

New International Institute For Maintenance Profession

The International Maintenance Institute, chartered under the laws of the State of Connecticut, has been formed to act as a clearing house for information, to disseminate technical knowledge, and to deal with practical problems and solutions in the whole field of industrial maintenance. As part of its activities the In-

stitute will hold seminars, conferences, and regional chapter meetings, bringing to members the newest techniques. Membership is open to accredited maintenance managers, supervisors, and key maintenance personnel. Further information can be obtained by writing to International Maintenance Institute, International Headquarters, Box 409, Greenwich, Conn.

Bliss to Move Offices

E W Bliss Co plans to move its corporate administrative offices from Canton, Ohio, to Pittsburgh where they will be located in the new Number 4 Gateway Center Building. The move, which will be made early in March, will not affect operations at the company's plant in Canton.

Worthington Expands in Alabama

Major expansion to cost in excess of $1 million has been scheduled by Worthington Corp for its air conditioning manufacturing plant at Decatur. Program will add 90,000 sq ft of production space.

Chevrolet to Build New Calif Plant

Chevrolet Motor Division of GMC will build a new automobile and truck assembly plant on a 400 acre site in Fremont. Construction will start this year with completion slated for the fall of 1962. The Fisher Body Division will also put up a plant on the site to provide bodies for Chevrolet passenger car assembly.

At present Chevrolet is operating separate passenger car and truck

"It's the Civil War Centennial—we're being paid in Lincoln pennies!"

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Meehanite Mandrels Reduce Tooling Costs

This 44" diameter by 64" long cylindrical mandrel weighs 8000 lbs. and is used for hydrospinning high strength missile casings. Many such Meehanite mandrels are now being used with good results to form parts for airframes, aircraft engines, missiles and other industries.

If you are producing conical, cylindrical and contoured parts by the power spinning process, Meehanite mandrels, that are machined, heat-treated to a hardness of about 50 Rockwell C and ground, offer many design, economic and production advantages.

High quality Meehanite mandrels reduce tooling costs by combining dimensional accuracy, high strength, fine surface finish and long service life.

For more information, send for your free copy of our new brochure on Meehanite Mandrels. Write to Meehanite Metal Corporation, 714 North Avenue, New Rochelle, New York.

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Here is a complete, 128-page hand and power tool buying guide for purchasing agents, engineers, production and maintenance officials — anyone concerned with the use of hand tools for assembly, maintenance, field service and original equipment repair kits.

Every type and size of tool is identified by number for quick, easy ordering. Important dimensions and specifications are clearly listed. Popular sizes of sockets and attachments designed expressly for powered nut runner and impact wrench use are included.

Also included is a complete range of automotive tools and shop equipment for fleet maintenance operations.

Ask the SNAP-ON Sales Engineer who calls at your plant for your FREE copy. Or write direct.

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SNAP-ON TOOLS

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plants in Oakland, Calif. Under present plans it'll continue to build Corvairs at the Oakland passenger plant and the truck facility will be converted into an expanded warehouse operation.

Lockheed to Build Air Transports

A $5 million letter contract for sixteen C130E Hercules prop-jets has been received by the Georgia Division of Lockheed Aircraft Corp. Order for the new troop and cargo-carrying aircraft is expected to total 50 over a two-year period with a total estimated program cost of $170 million.

Sylvania's First Southern Plant

Sylvania Electric has begun construction of a $3.5 million facility in Columbia, SC. Plant will be the second in the nation for Sylvania Argus Cameras Division, producer of slide projectors and motion picture machines. All of the firm's projectors will be made eventually at Columbia.

Metric Thread Bolts and Nuts

Steel Co of Canada, Ltd, Toronto, is reportedly the first North American manufacturer to stock and supply hexagon head bolts and nuts produced to the latest standards of the International Metric System. Demand for metric threaded fasteners is increasing not only in countries where the system is standard but also in North America for servicing European-made cars and machinery

"I don't like the sound of that machine."

Electronic parts courtesy Judson Mfg. Co., Inc., Cornwells Heights, Pa.

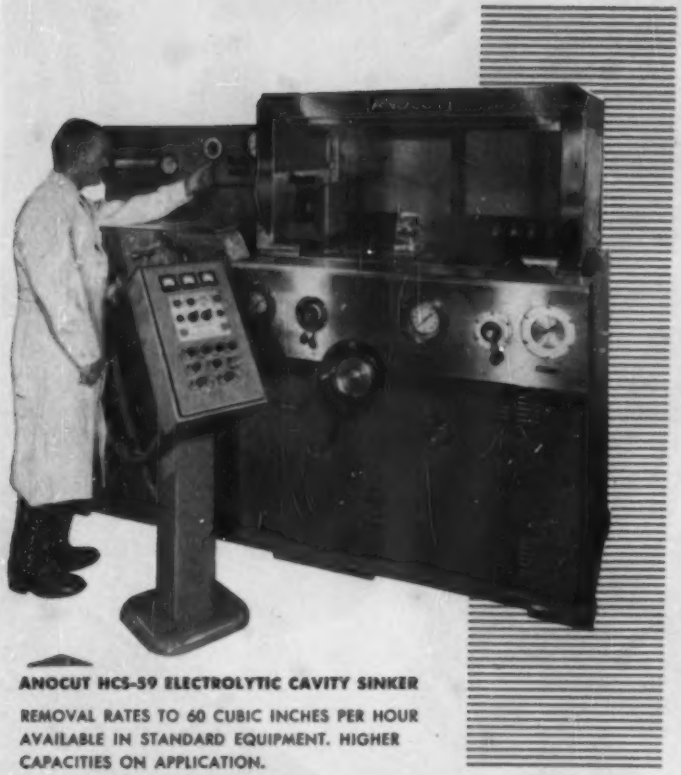
Mirror-bright without polishing, after switch to Sunicut

Boring on a multiple-spindle automatic produced the finish you see on these electronic parts. Sunicut 102-S Cutting Oil saved time and money by eliminating the polishing operation. The same automatic uses Sunicut 102-S to machine metals ranging from titanium to stainless 410.

Sunicut 102-S is one of a full line of cutting oils known throughout metalworking for maintaining long tool life, close tolerances, and fine finishes. There's a grade of Sunicut that can help you improve your product quality—and *that's* the best economy of all.

To choose the right Sunicut, ask the Sun man; that's part of his service to you. Or write to SUN OIL COMPANY, Dept. AM-1, *Philadelphia 3, Pa. In Canada: Sun Oil Company Limited, Toronto and Montreal.*

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES



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REMOVAL RATES TO 60 CUBIC INCHES PER HOUR AVAILABLE IN STANDARD EQUIPMENT. HIGHER CAPACITIES ON APPLICATION.

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IN PRODUCTION...

Cavities in this jet-engine "bucket" made of A-286 super alloy are produced two at a time in 8 minutes. Previous time 32 minutes.

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and for assembling industrial equipment constructed in NA, to European standards, for use abroad. The fasteners can be furnished in a range of sizes from 6 to 14 mm in diameter and in lengths up to 150 mm.

Motch & Merryweather . . .

. . . will handle sales of Cleveland Punch & Shear Work's line of mechanical power presses for the metal stamping industry. M & M sales and service facilities in Cleveland, Detroit, Pittsburgh, and Cincinnati will be augmented by Cleveland Punch's own staff of engineers. Joseph F Lacchia, Cleveland's factory representative in Michigan, will have his office in the M & M headquarters in Detroit.

Harper Gets B-70 Contract

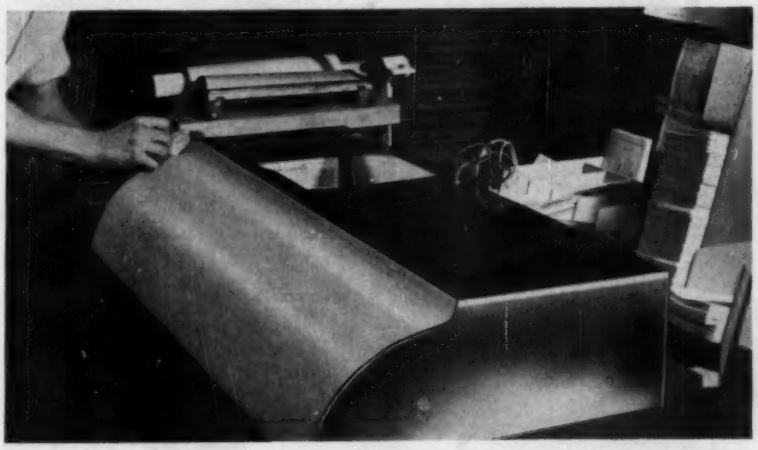
The Metals Division of H M Harper Co, Morton Grove, Ill, has been awarded a major contract (value not disclosed) for extruded specialized stainless steel shapes for the B-70 Valkyrie bomber. The firm will supply North American Aviation, producer of the plane, with about 105 different types of extruded shapes that'll be used as structural members.

Name Changes

Detroit Controls Division of American Radiator & Standard Sanitary Corp will now be known as the **American - Standard Controls Division.** Geographical expansion of the division's manufacturing operations far beyond the Detroit area was one important reason for the name

"Did you remember the cream and sugar?"

from die to delivery with no repolishing!



metal formed without a scratch when covered with protective

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Now you can stamp, blank or fabricate highly polished metals by first covering the area to be worked with "Scotch" Brand Protective Tape. Even light draws may be made without die-marking the finished surface. Nor is repolishing necessary. On most products, the tape can even stay-put up to point of use.

TRY THIS METHOD. See for yourself how "Scotch" Brand Protective Tapes save both time and rejects in your plant. Ask your nearest "Scotch" Brand Tape Distributor to show you how, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn. Dept. IBA-11.

SCOTCH BRAND tapes for industry

Minnesota Mining and Manufacturing Company

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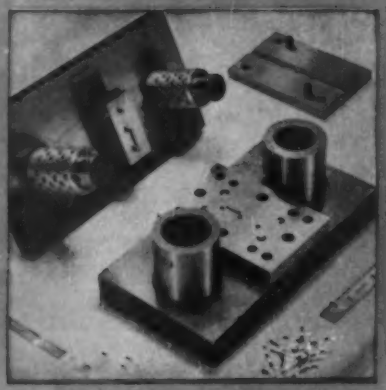
To the best of our knowledge, Lempco is the only 2-post STOCK* die set which could produce this electronics part from .001" thick high nickel alloy material—with punched holes of .001" diameter. This die, mounted in a standard Lempco STOCK* die set, produced 30,000 burr-free parts on its initial run.

MATERIAL: .001" Thick, High Nickel Alloy
Punched Holes, .001" Diameter

Users everywhere have found that a STOCK* Lempco 2-post die set will out-produce special 4-post "friction type" sets—at a fraction of the cost. You can prove this to yourself!

*Off-the-shelf DELIVERY, with warehouse stocks in all major metalworking areas of the U.S.A.



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change. The Detroit-headquartered organization employs 1800 persons in the manufacture and marketing of valves, controls, and indicating instruments.

North American Aviation has changed the name of its Missile Division to **Space and Information Systems Division** to more accurately indicate the nature of activities to be followed at the Downey, Calif, division.

Durant Consolidates Facilities

Durant Manufacturing Co of Milwaukee and Watertown, Wis, will spend $280,000 for expansion of the Watertown plant and will move all of its Milwaukee operations there in order to consolidate engineering and manufacturing of the firm's electronics products.

Roberts Co . . .

. . . Sanford, NC, manufacturer of textile machinery, has broken ground for the first 105,000 sq ft of what will eventually be a 350,000 sq ft manufacturing plant. Move will consolidate the firm's Sanford facilities which are presently located in seven buildings.

AF Orders in Miami

Aerodex Inc, Miami, one of the country's leading aircraft engine overhaul facilities, has received more than $10 million worth of new Air Force contracts which will increase employment at the company from the current 1700 to 2000 next year.

FMC Gets Mauler Contracts

Two major contracts totaling $4.9 million covering work on the Army's Mauler, a mobile battlefield air defense missile system, have been awarded to Food Machinery & Chemical Corp's Ordnance Division plant in San Jose, Calif. In addition to these new orders, the Division is working on an initial $34.6 million Army Ordnance contract for aluminum-armored personnel carriers.

J79-5B Turbojet Engines . . .

. . . for the B-58 Hustler will be produced under a $22.6 million AF contract by General Electric's Large Jet Engine Department at Cincinnati. Order covers minimum production for two full wings and delivery is scheduled through 1962. •

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 TURRET DRILL—*Cincinnati Lathe & Tool Co, 3207 Disney St, Cincinnati 9, Ohio.* 8-page catalog N-260 describes and illustrates the Cintimatic, six-turret numerically controlled machine providing completely automatic drilling for a wide range of work. In addition to worktable positioning, the Acramatic console controls tool selection, feed, spindle speed, hole depth, and tapping cycle. Setup is further simplified by a tool length compensator which adjusts for work height and tool length.

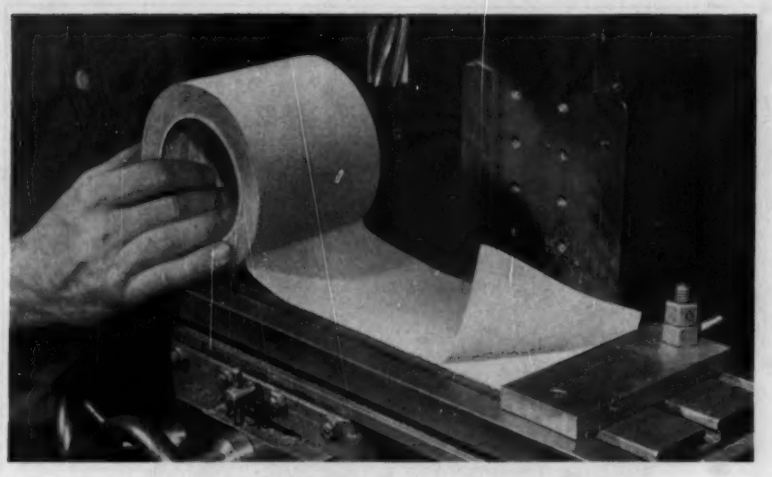
2 MACHINE TOOLS—*Bardons & Oliver Inc, 1133 W 9th St, Cleveland 13, Ohio.* 4-page illustrated brochure covers complete line including five different ram type and saddle type turret lathes offering collet capacities from 1 to 5 in. Also shown is the complete line of cutting-off lathes in ten different sizes with collet capacities from 2 to 16 in. Lists detailed specifications for both types of lathes.

3 CENTERLESS GRINDER — *Landis Tool Co, Waynesboro, Pa.* 6-page catalog RCNT-60 gives details on the Landis 12R. Features described that enable the machine to produce work-pieces to the closest tolerances ever expected from this process. Extra stability, from the floor up, makes heavy cuts possible without sacrifice of finish or accuracy.

4 POWER PRESSES — *Havir Manufacturing Co, 444 Cleveland Ave, St Paul, Minn.* 8-page catalog features the Press-Rite power press line from 2 through 85-ton capacity. The new 55 and 70-ton units, available with Airflex air friction clutch and air-applied brake, are described. Automatic feed, available on all models for the first time, is also highlighted.

5 METAL SPINNING — *C W Torngren Co, 236 Pearl St, Somerville 45, Mass.* 8-page brochure discusses new advances with the Mecatorn Powerspun, a hydraulically controlled semi-automatic process. Hydraulic feedback control automati-

"Very good worker, but very unsociable."



holds any metal like a magnet!

lock down nonferrous metals for milling with double-coated

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Keep nonferrous or small, hard-to-clamp parts where you want them during machining and finishing operations. "Scotch" Brand Double-Coated Tape goes on quickly . . . holds tight even under a flood of cutting fluid. This "tape that sticks on both sides" speeds such operations as cutting, grinding, milling and polishing.

TRY THIS METHOD. Ask your nearest "Scotch" Brand Tape Distributor to demonstrate this and the many other "Scotch" Brand Tapes for masking, surface protection, and metal finishing. Or, write: 3M Co., 900 Bush Ave., St. Paul 6, Minn. Dept. IBA-11.

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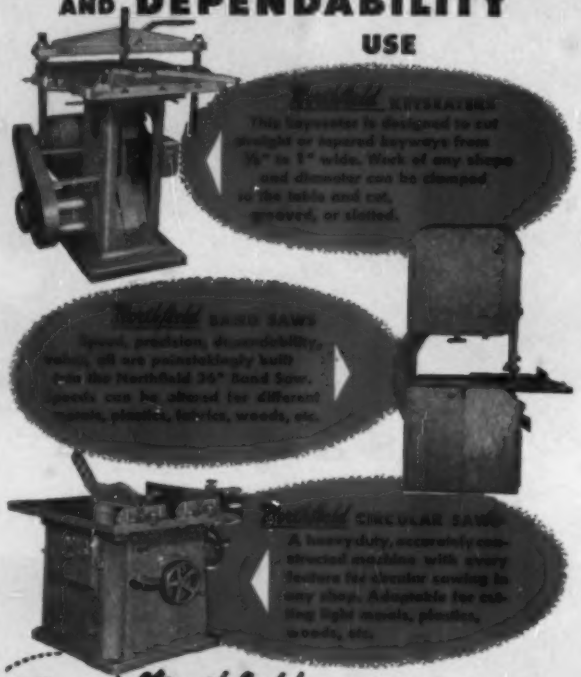

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Wilson TUKON testers make and measure extremely shallow indentations. They are used, for example, by manufacturers of watches, hairsprings, needles and jewels. In laboratories, TUKON instruments test individual crystals or microscopic particles. On any job, they provide these important advantages:

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A complete line of Wilson Rockwell instruments is available, including semi and fully automatic models.

For Perfect Readings Every Time, use Wilson "Brale" Diamond Penetrators for Rockwell testers, and Knoop and 136 Square Base Pyramid Indenters for microhardness testing.

Write for details—Ask for Catalog RT-58. It gives complete information on the TUKON tester as well as on the full line of Wilson Rockwell hardness testers.

Wilson TUKON hardness tester

WILSON "ROCKWELL" HARDNESS TESTERS

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Free Literature

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cally duplicates close tolerances either for prototype development or longer production runs. Pressures up to 200,000 psi are exerted through the hydraulic system on the Mecatorn machines enabling them to spin ⅝-in. stainless steel and non-ferrous metals up to 1½ in. in thickness.

● SCRAP BRIQUETTING PRESS — *Milwaukee Foundry Equipment Division, SPO, Inc, 6430 W Bruce St, Milwaukee 46, Wis.* Bulletin BP-217 illustrates and describes full size range of scrap briquetting presses which have been designed to convert chips, turnings, and borings into high grade scrap. Model AL-1000 Milwaukee unit is capable of forming up to 9 tons of scrap per hr into dense cylindrical briquettes which can be charged directly into furnace or foundry cupola. Specifications charts give various capacities of the six models which make up the line. Request direct on company letterhead.

TOOLS AND ACCESSORIES

6 PRESS LOAD INSPECTORS — *Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY.* Product Report No. 2 pictures and describes two electronic precision instruments designed to safeguard dies and presses during production runs. These are: Load Monitor which continuously registers all press loads on a given press and, by means of a tripping circuit, disengages the clutch to prevent overload repeats; Tonmeter, a portable, battery-powered instrument for measuring the load imposed.

7 ELECTRIC SPEED MEASUREMENT SYSTEMS—*Meriam Instrument Co, Electronic Division, 10920 Madison Ave, Cleveland 2, Ohio.* 4-page bulletin 1000 discusses operation and selection of self-generating 3-phase electric speed measurement systems. Designed for heavy-duty operation in both hazardous and non-hazardous atmospheres, they will measure rotary movement with accuracy of 0.3 of 1% of full scale within the linear range. Four component part sections cover electric tachometer generators; electric tachometer indicators; explosion-proof housings; and electro-mechanical vibrators. ●

"I don't stop for lunch when I'm on piece work. I just carry some concentrated vitamin tablets."

NAMES IN THE NEWS

Hupp Corp has appointed **John G Morgan** manufacturing manager of **Hupp Aviation Division,** Chicago. Prior to his promotion he was chief manufacturing engineer.

Allis-Chalmers Manufacturing Co has appointed **Carl G Meyer** manager of the engine material handling branch at Atlanta. **Merrill E Morgan** has been named to succeed Mr Meyer as material handling sales manager at the company's Oakland, Calif, branch.

Chrysler Corp has promoted **Charles W Kelley** from managing engineer of body, paint, and trim to manager of product engineering for Dodge cars.

Thiokol Chemical Corp has named **Dr Edward H Seymour** to the post of general manager of the Reaction Motors Division at Denville, NJ. Formerly director of research for the division, he succeeds **Raymond W Young** who has been appointed director of advance planning.

Ford Motor Co has named **Robert R Cosner** plant manager of the chassis parts plant in Sterling Township, Mich. Formerly administration manager at Sterling, he succeeds **John A McCabe** who was recently named general manufacturing manager for Ford of Australia.

Carborundum Co, Niagara Falls, NY, has named **Ernest L Anderson Jr** director of purchasing. He was formerly director of purchases at Brown & Sharpe Manufacturing Co, Providence, RI.

Foxboro Co, Foxboro, Mass, manufacturer of instruments, has appointed **C Schwarzler** vice president, marketing. He was previously manager of international operations. **H O Ehrisman,** general sales manager, has been named vice president and US general sales manager. **V V Tivy** has been promoted from chief application engineer to director of engineering.

Bullard Co, Bridgeport Conn, has appointed **Leo W Sheehan** district sales manager in the Detroit area.

American Chain & Cable Co, Bridgeport, Conn, has named **George W Herman** manager of the Allison

flux stays put...
air stays out!

smoother welds every time when back-up tool is glass cloth

TAPES FROM 3M

As a back-up material in submerged arc welding operations, "Scotch" Brand Glass Cloth Tape holds flux in . . . keeps unwanted air out. Tape adheres instantly to underside of girth or longitudinal seams for butt, double V and fillet type welds. Its use overcomes need for expensive jigging or other cumbersome back-up methods used to prevent burnout.

TRY THIS METHOD. See how it minimizes your flux waste and clean-up costs. Ask your 3M Representative or nearest "Scotch" Brand Tape Distributor for a demonstration, or write: 3M Co., 900 Bush Ave., St. Paul 6, Minn. Dept. IBA-11.

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Our inspection projector magnifies cutting edges to eliminate the minute angular deflection that could cause you costly production losses . . . just one of many inspections that account for Circle R quality.

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American Machinist/Metalworking Manufacturing
330 West 42nd Street, New York 36, N. Y.

NAMES IN THE NEWS

abrasive wheel plant of the Allison-Campbell Division.

Continental Screw Co, New Bedford, Mass, has appointed **Edward Pettengill** manager of production control. **Robert L Trip** has been made purchasing agent.

Associated Spring Corp, Bristol, Conn, has elected **Wallace Barnes** executive vice president. He retains his position as secretary of the corporation.

General Electric Co has named **Marshall Anderson** manager of manufacturing at the General Purpose Control Department, Bloomington, Ill.

United Aircraft Products Inc, Dayton, Ohio, has appointed **Frank A Ryan** vice president and general manager of western operations. He'll also head the firm's Gardena, Calif, plant.

International Research & Development Corp, Worthington, Ohio, has named **Eugene G Hart** president to succeed **George B Moore.** Mr Hart was formerly vice president, marketing.

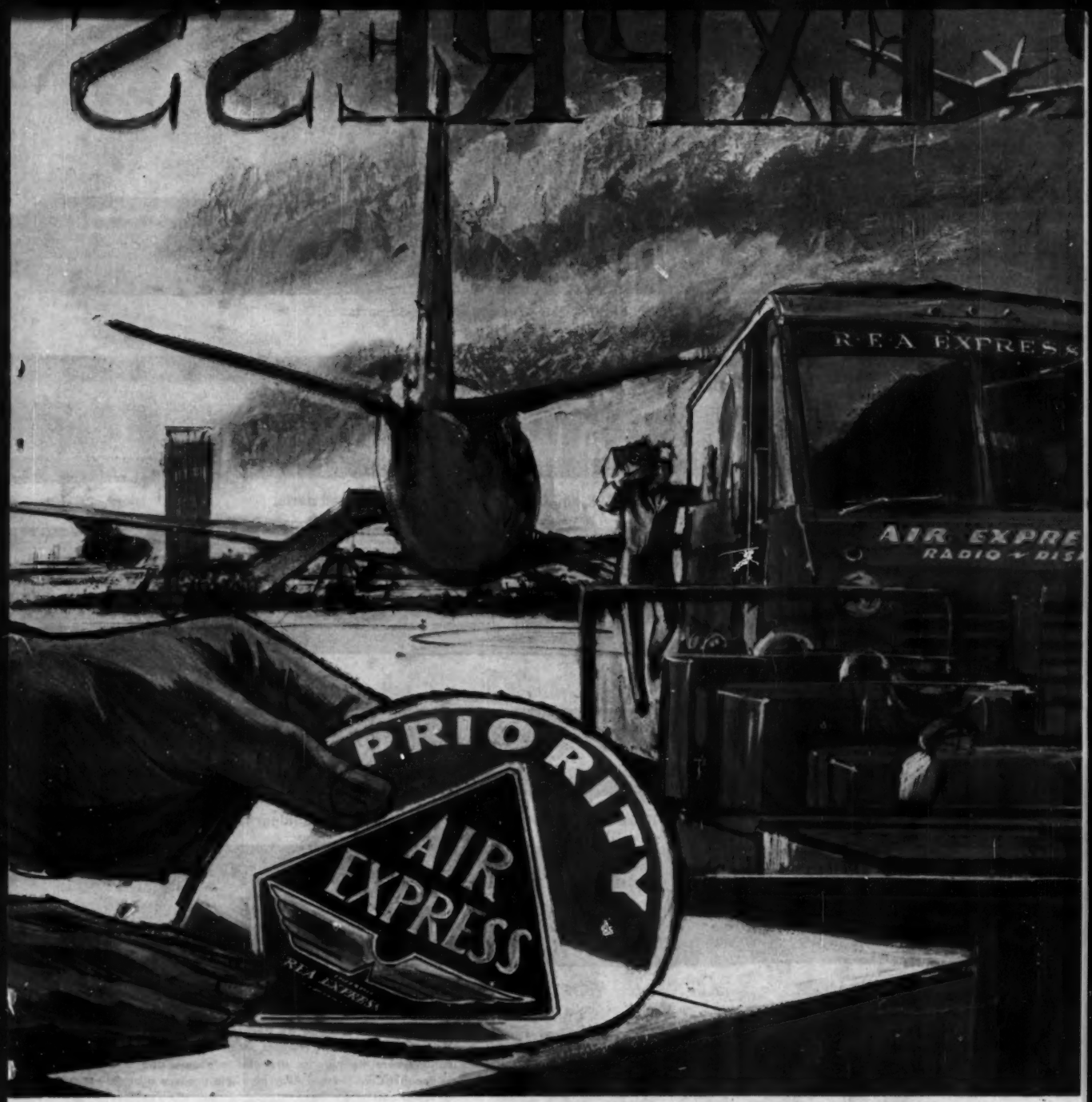
Kaydon Engineering Corp, Muskegon, Hich, has appointed **Harold R Dobb** sales manager of the **Frauen**sistant sales manager.

Johnson Bronze Co, New Castle, Pa, producer of sleeve bearings and powder metallurgy parts, has named **John J Brice** vice president, sales. He was formerly manufacturing manager.

Clarostat Mfg Co, Dover, NH, manufacturer of potentiometers and resistors has named **John O'Malley** superintendent of manufacturing.

United Shoe Machinery Corp, Shelton, Conn, has named **Jack H Schofield** product sales manager for the Pop rivets line. He moves up from the post of assistant product sales manager.

Automatic Plastic Molding Co, Berkeley, Calif, has named **Ron Wallace** production manager. He has been serving as a technician with the firm.



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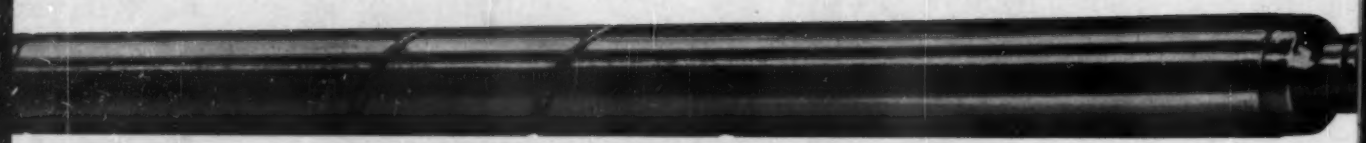
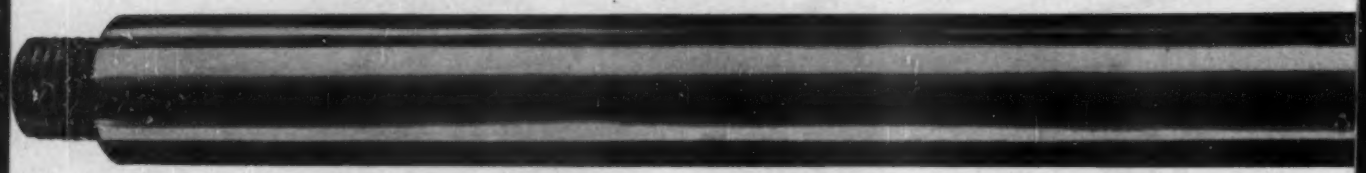
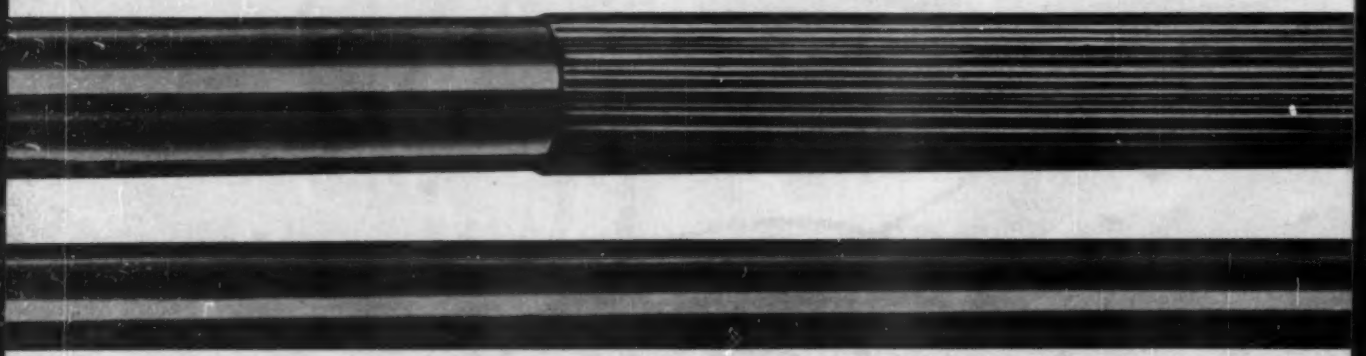


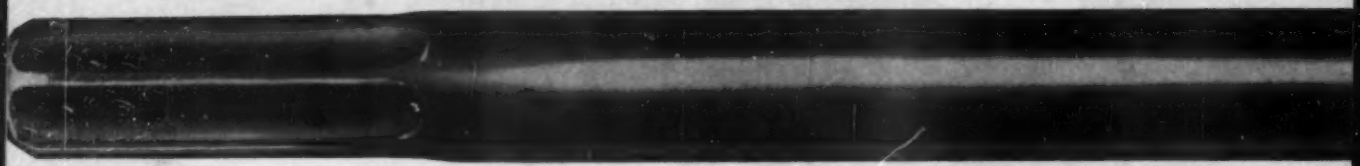
CENTURY SERIES C-1144 for highly machined parts.



CENTURY SERIES C-1141 and C-1151 for moderately machined parts.



CENTURY SERIES C-1050 and C-1045 for parts where machinability is a minor factor.

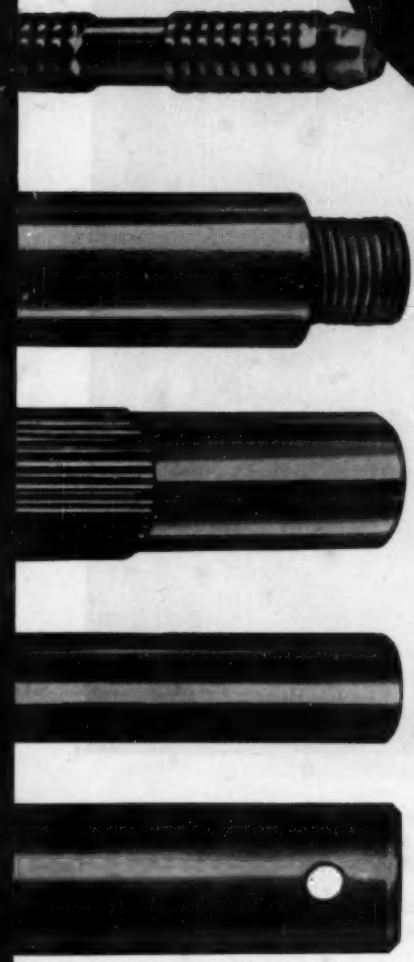


WRENCH SOCKETS, made by Herbrand Division of The Bingham-Herbrand Corporation, Fremont, Ohio, illustrate the kind of application where the superior strength, toughness, and machinability of *Republic Cold Finished Alloy Bars* help produce a better product at lower cost.

Bars are formed, drilled, and cut off in an automatic screw machine, then hot broached to shape internal dimensions. Final stages of socket production include heat treat and chrome plating. Mail coupon for more data on Republic Alloy Bars.

ROTOR BUCKETS for Mechanical Drive Turbines manufactured by Elliot Co., Jeanette, Pa., are produced from *Republic Stainless Steel Special Sections* . . . an excellent example of how Republic Special Sections save money on tough-to-make parts.

User benefits include: simplified machining, corrosion and abrasion resistance, greater strength and hardness, smooth surfaces that reduce or eliminate finishing operations. Available in a wide range of sizes and contours . . . carbon, alloy, stainless steel, and titanium. Send coupon.



Cut Material Costs on High Strength Parts

Republic CENTURY 100 SERIES Cold Finished Bars

LET YOU CHOOSE FROM 5 GRADES, 5 DEGREES OF MACHINABILITY, 5 PRICE LEVELS

With Republic's CENTURY SERIES of high strength, stress-relieved, cold finished steel bars, you pay only for the machinability you need to meet your production requirements. CENTURY SERIES bars are priced on a descending scale (as machinability decreases, price drops). This makes it possible for you to realize important savings by selecting lower-sulphur-content, high-strength-toughness-ratio bars for applications where machinability is not of prime importance. Each of the five grades has a minimum yield strength of 100,000 psi.

PRODUCTION FACILITIES for CENTURY SERIES bars are strategically located in key metalworking markets to serve you better. Result: faster deliveries, and expert metallurgical service, *when you need it,* on the complete line of Republic Cold Finished Steel Bars. For more information on CENTURY SERIES bars and Republic Metallurgical Services, send the attached coupon.

This STEELMARK of the American Steel Industry tells you a product is made of Steel. Look for it when you buy. Place it on the products you sell.

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- ☐ CENTURY SERIES
- ☐ American Steel Industry STEELMARKS
- ☐ Cold Drawn Special Sections
- ☐ Cold Finished Alloy Steel

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Company_____

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Allison-Campbell

ABRASIVE CUTTING KNOW-HOW

ACCO
for Better Values

With this Campbell Machine, you can--

Cut 6-inch Diameter Hard Alloys-Cleanly and Accurately-in Less Than 3 Minutes!

• This Campbell wet abrasive cutting machine—the Model 406—will cut tubing, bar stock, angle iron, or any other shape up to 6″ round or square—and it will cut practically *any* material, including the new super alloys and exotic metals. Like all Campbell machines, it's designed to give *accurate* cuts, quickly and cleanly.

HIGH SPEED—4 to 8 seconds per square inch is the normal cutting speed for all Campbell wet abrasive cutting machines. For instance, you can cut 6″ diameter hardened steel in less than 3 minutes.

ACCURACY—Campbell machines are production machine tools. They cut within close tolerances to reduce rejects and scrap loss. For example, the Model 406 will cut 3″ diameter material to lengths within ±.010″, 6″ diameter within ±.030″.

FINE FINISH—Additional finishing operations are rarely required. There is no burn, and burr has been reduced to an absolute minimum.

POWER OSCILLATION—On an oscillating-type machine such as the Model 406, the cutting wheel is moved horizontally back and forth *across* the cut as the wheel is fed downward. The result—greater cutting capacity, with longer wheel life.

PROPER COOLANT APPLICATION—Large reservoir and a 33 gallon/minute pump provide high volume of coolant. Unique Campbell distributor applies coolant equally to both sides of the wheel—an essential requirement for accurate cuts.

OTHER CAMPBELL MACHINES FOR ANY CUT-OFF NEED

Choose from four types of Campbell machines for wet or dry cutting—chop stroke, oscillating, horizontal or rotary—with capacities up to 14″ rounds, 12″ billets, plate up to 6″ thick and 20 ft. long.

Regardless of your application, you'll find that a Campbell machine provides you with the best cut-off method for modern production techniques—far more efficient, accurate and economical for cutting many materials than other cutting equipment.

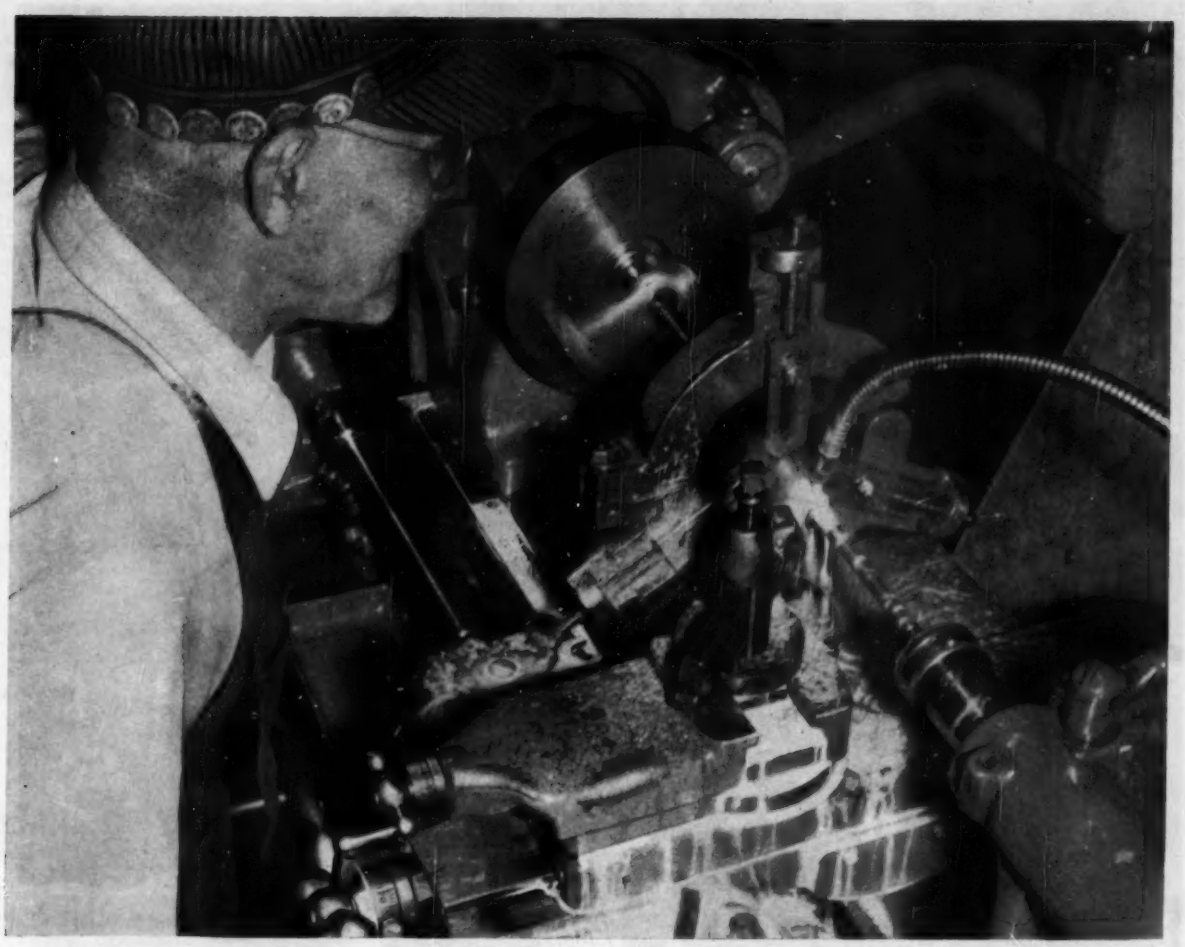
WRITE FOR DETAILS—Bulletin DH-260 gives the complete story on the Campbell Model 406 abrasive cutting machine. We'll also be glad to send you information on other machines; just tell us your cut-off application. And remember—your Allison-Campbell Field Engineer is an abrasive cutting specialist. Call on him for expert advice.

ACCO

CAMPBELL ABRASIVE CUTTING MACHINES

Allison-Campbell Division • American Chain & Cable Company, Inc.

923 Connecticut Avenue, Bridgeport 2, Conn.

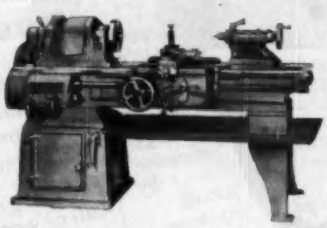


Dependability you can count on / *South Bend 16" engine lathe*

- Ruggedly designed, accurately built to give long trouble-free service.
- Exceptionally accurate—and they stay accurate.
- Microfinished sleeve type spindle bearings for smoother w[illegible], longer life, more accuracy, greater spindle support.
- Hardened and ground bed ways for extreme operating conditions available at small extra cost.
- Trouble-free belt drive to spindle—no noise, no vibration, no gear marks.

16" LATHE SPECIFICATIONS

Swing over bed and saddle wings — 16¼". Distances between centers (6 bed lengths) — 33", 45", 57", 81", 105" or 129". Collet capacity — 1⅛" max. Spindle speeds — 6, 8, 12 or 16. Threading feeds — 48 (4 to 224 per in.). Longitudinal feeds — 48 (.0015" to .0841"). Cross feeds — 48 (.0006" to .0315").



Prices of South Bend 16" Engine Lathes start at $2591 f.o.b. factory.

Time payments—3¼% interest per year on unpaid balance, up to 36 months to pay.

SOUTH BEND LATHE

South Bend Lathe, Inc., South Bend 22, Indiana

Please send information on lathes, milling machines, shapers, drill presses and pedestal grinders.

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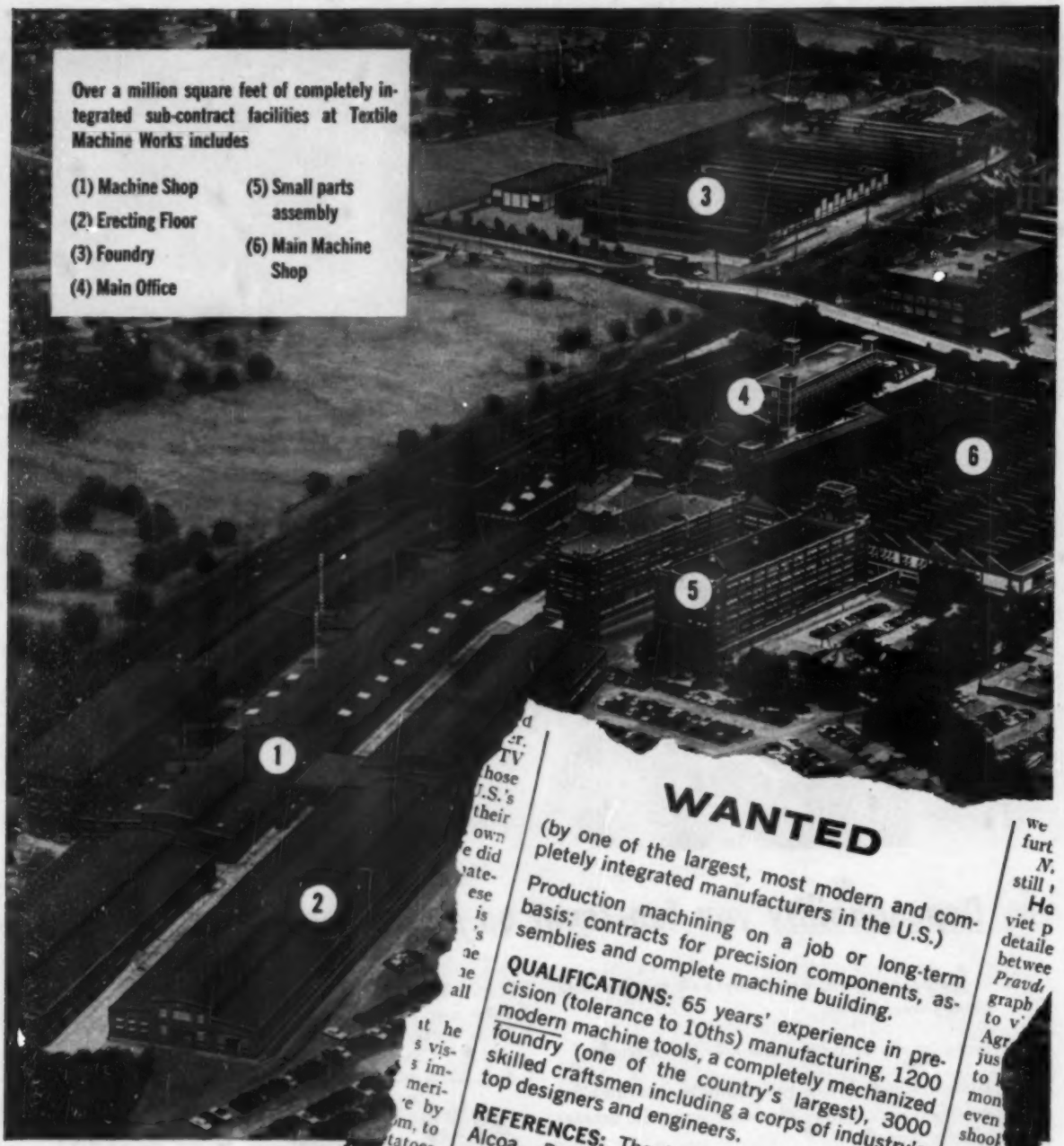

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Production machining on a job or long-term basis; contracts for precision components, assemblies and complete machine building.

QUALIFICATIONS: 65 years' experience in precision (tolerance to 10ths) manufacturing, 1200 modern machine tools, a completely mechanized foundry (one of the country's largest), 3000 skilled craftsmen including a corps of industry's top designers and engineers.

REFERENCES: The best . . . companies like Alcoa, Du Pont, Chrysler, Eastman Kodak, Western Electric, Fairchild Aircraft, Ingersoll-Rand and others who know they can depend on TMW for quality, accuracy and on-time delivery at minimum costs.

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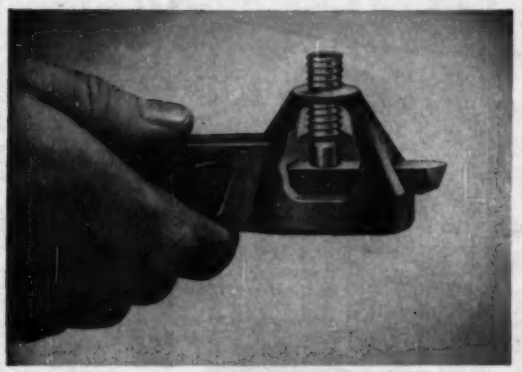
CONTRACT DIVISION, READING, PENNA.

Practical Tooling Tips

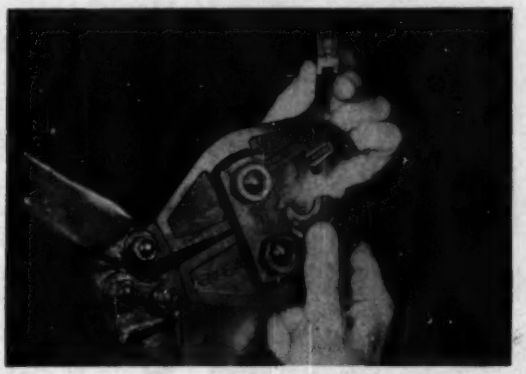
Number 1 of a series.

Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?



TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad® Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.

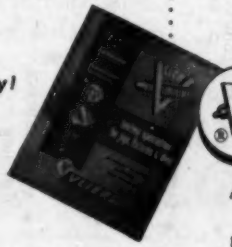
EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad® Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad® Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.



SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.

THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

New catalog now ready! Send for your copy today.



Insist on Vlier Tooling Specialties... there's still no substitute for quality.

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15 years engineering and millions of dollars invested* to perfect the world's finest brake...today's PACIFIC HYDRAULIC PRESS BRAKE

Over 9 out of every 10 hydraulic press brakes in operation today are PACIFIC providing...

- More dependability
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- Simpler hydraulic control
- More accuracy in level control
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- More operating convenience
- Greater visability
- More rigidity in cylinder construction
- Shock-free hydraulic system suitable for punching

Shearing attachment increases press brake productivity 65%

The Pacific hydraulic press brake at Wyatt & Kipper, Seattle, Wash., was formerly used only 15% of the time during regular 40 hour weeks in bending plate and special forming. By adding a Pacific shearing attachment to perform cutting that had been previously burned or jobbed out, brake utilization increased to 80% and the need for a separate $27,000 shear was eliminated. By forming and shearing on the same machine, an additional $600 a year cost for floor space otherwise required is saved. With a single connecting load charge, power costs are substantially less. Shearing attachment takes only 12 minutes to install; 7½ minutes to remove. Cuts 10 gauge sheet to 5/16" stainless or ½" mild steel easily. On production jobs, machine cuts as fast as steel can be moved.

*THIS INVESTMENT ENABLED PACIFIC TO INTRODUCE:

- Tape control to synchronize cylinders within .003" (1947)
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- Precision depth control to repeat accuracy within .001" (1951)
- Manual turret stroke controls for progressive bending (1952)
- Selective anti-whip speeds to eliminate reverse bends (1952)
- Tandem operation of press brakes for forming pieces 40 ft. or longer (1953)
- Tonnage control to protect light dies in heavy press (1953)
- Multiple hydraulic cushion cylinders for deep drawing (1954)
- Overhead integral power unit for increased accuracy (1955)
- Cylinder ram guides for increased rigidity (1956)
- Shearing attachment for shearing heavy plate on press brake (1958)
- Pipeless stacking of valves to eliminate pipe breakage and leakage (1959)
- Shockless hydraulic valving to eliminate cause of leakage (1959)

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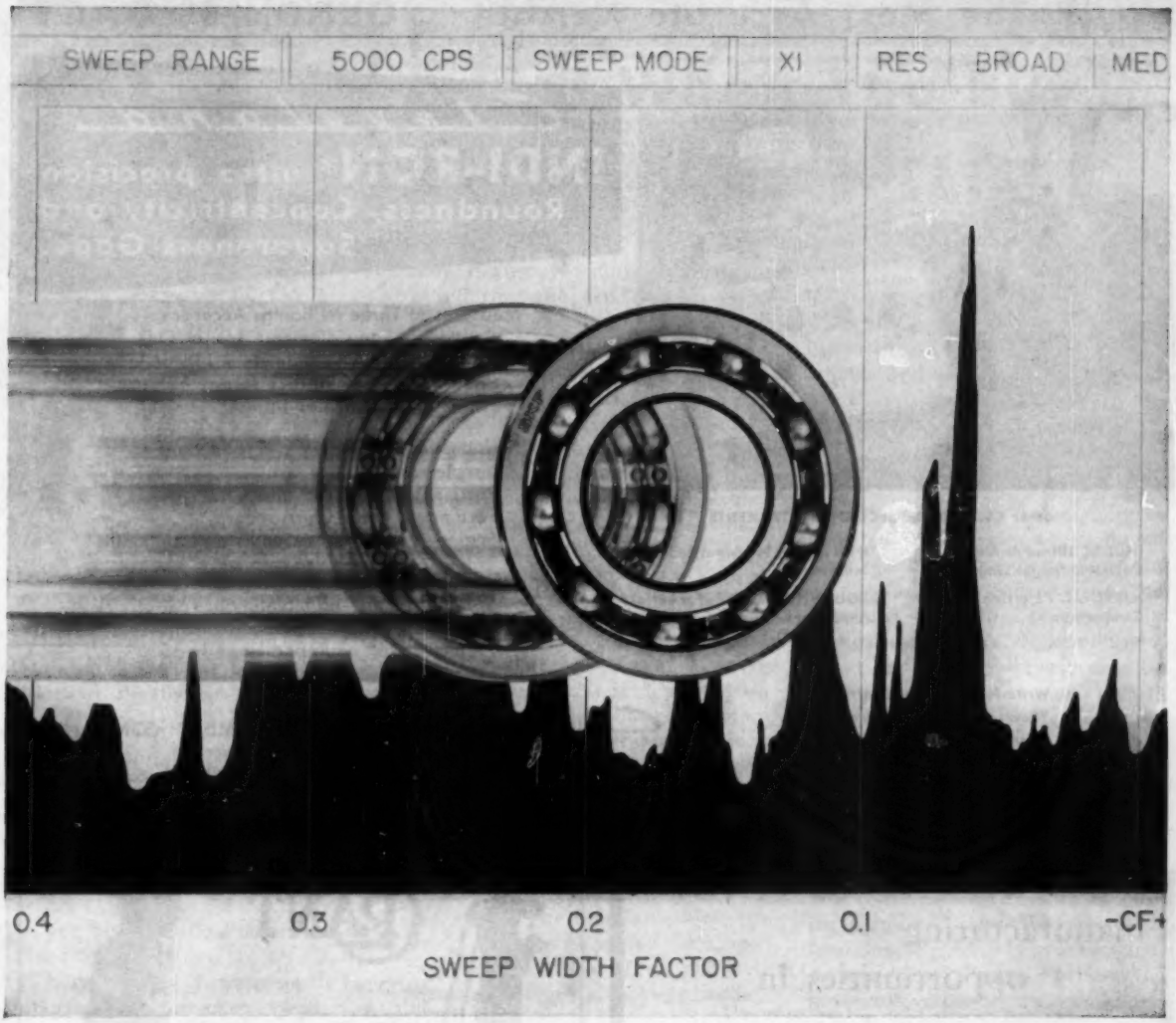

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METALS

In MANITOBA there are opportunities existing for companies or parties who are looking for a small Canadian manufacturer who can develop, produce, and market metal products. These products will either be existing or will still be in the idea or planning stage.

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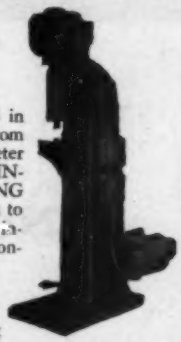
Write for literature and don't forget to send samples.



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STEEL BLUE
Stops Losses
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CIRCLE 239 READER SERVICE CARD

Are You Getting All That You Are Paying For When You Buy Cold Finished Steel Bars?

STANDARDS YOU CAN FOLLOW TO ASSURE BUYING THE BEST WITHOUT PAYING A PREMIUM

All cold finished steel bars are manufactured to industry standards.

But what you don't receive when you order just any cold finished steel bar are the *extra quality features* you get only in Bliss & Laughlin bars. You can *see* the difference... you can *work* the difference ... you can *have* the difference *at no extra cost.*

These quality features can be important in a number of ways:

PATENTED LUSTERIZED® FINISH

Lusterized finish means that the bar is cleaner, brighter, free from processing grit, lime and oils.

Because of this freedom from contaminants, machining costs are reduced, collet mechanisms are less likely to jam, and tool life is longer. If plating is required, preparation time is substantially lower. The surface can often be used for finished components without machining.

The patented, exclusive process, applied to all Bliss & Laughlin cold finished bars, is a development of Bliss & Laughlin research.

CLOSE TOLERANCES

The industry's closer tolerance standards, adopted several years ago, were also a development of Bliss & Laughlin pioneering work in improving manufacturing processes and procedures.

Long before they became industry standards, these closer tolerances were routinely followed by Bliss & Laughlin. You can therefore expect these close tolerances to be consistently maintained in all Bliss & Laughlin production.

SPECIAL SOIL-FREE COATING

After a protective layer of rust-inhibiting material is deposited on the bar during the Lusterizing process, a special, exclusive, transparent protective oil is added. This special coating repells contaminants and moisture during shipping and storage. It doesn't soil hands as do other protective coatings.

Bliss & Laughlin Lusterized bars are cleaner to handle, cleaner to work, and can be stored for longer periods without fear of rust and contamination from airborne material.

FAST, NATION-WIDE SERVICE

You can purchase Lusterized cold finished steel bars in mill quantities directly from strategically located Bliss & Laughlin mills across America or from steel service centers everywhere.

Available in rounds, squares, hexagons, flats and special sections, Lusterized bars are furnished in carbon and alloy steels. Either can be leaded.

MACHINABILITY AND METALLURGICAL SERVICE

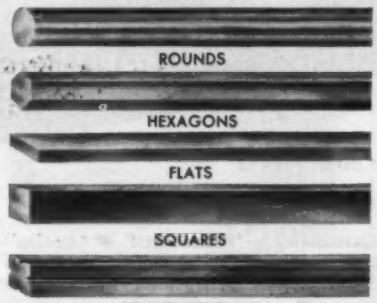
Take full advantage of Bliss & Laughlin's extensive research and development work on the machinability and metallurgy of cold finished steel bars. This service costs nothing and can mean more profits.

UNQUESTIONED DEPENDABILITY

For 70 years, Bliss & Laughlin has devoted its energies to producing only one line of products—cold finished steel bars. America's leading specialist, with the industry's most complete and most flexible mill service, Bliss & Laughlin concentrates its substantial resources and nationwide facilities on serving customers well and dependably.

* * * * *

These are the standards you can follow when you wish to buy the best cold finished bar, without paying premium prices. Why settle for less? Simply specify Bliss & Laughlin *Lusterized* cold finished steel bars the next time you order or inquire.



These additional quality features are available only in BLISS & LAUGHLIN LUSTERIZED COLD FINISHED STEEL BARS

Specialists in Finish, Accuracy, Straightness, Strength and Machinability

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GENERAL OFFICES: Harvey, Ill. • MILLS: Harvey, Detroit, Buffalo, Los Angeles, Seattle, Mansfield, Mass.

Leading Independent Producer of Cold Finished Steel Bars

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EASTERN AIR LINES

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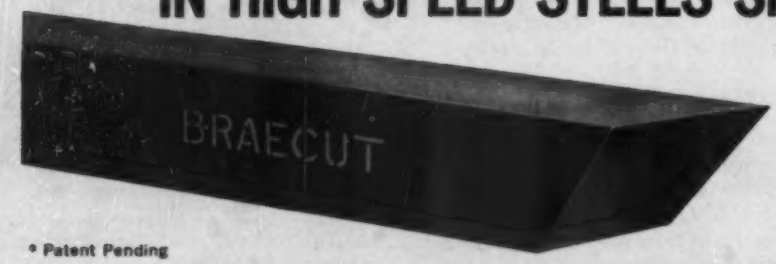
IS BRAECUT* THE MOST NOTABLE ACHIEVEMENT IN HIGH SPEED STEELS SINCE 1955?



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- Designed for Difficult Jobs
- Grinds Easily
- Remarkably Tough

* Patent Pending

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"Outstanding"—"Phenomenal"—"Amazing"—are adjectives applied to bRAECUT by tool engineers who have tried this new high speed steel. Designed for High Temperature Alloys and high strength steels, its performance ranks with the most significant advances in the science of metal cutting.

You will be interested in testing BRAECUT if you have appropriate applications. No special grinding equipment is needed. Write, wire or phone your nearest Braeburn sales office to arrange for a BRAECUT test. Available in standard tool bit sizes.

• Studies now being conducted in the following applications: Broaching, Reaming, Milling, Tapping, Hobbing, and Drilling.

Braecut Bulletin #61A on Request

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BRAEBURN ALLOY STEEL DIVISION

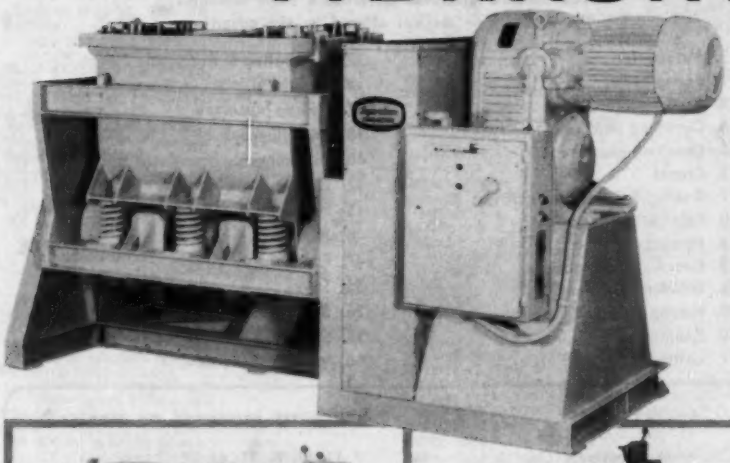
CONTINENTAL COPPER & STEEL INDUSTRIES, INC., BRAEBURN, PA.

SALES OFFICES: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • INDIANAPOLIS • LOS ANGELES • MILWAUKEE NEW BRITAIN • NEW YORK • NORTH MIAMI • PITTSBURGH • ROCHESTER • WORCESTER • YOUNGSTOWN
SERVICE CENTERS: BRAEBURN, PA. • CHICAGO • CLEVELAND • DETROIT • FLORENCE, ALA. • LOS ANGELES NORTH MIAMI • ROCHESTER • WORCESTER • YOUNGSTOWN

UP TO 100 TIMES FASTER FINISHING WITH

ALMCO

VIBRASHEEN



ALMCO'S FULL LINE OF NEW VIBRASHEEN MACHINES

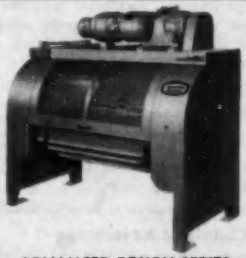
MODELS VT-717 — 712
(18 and 12 cu. ft. capacities)
Ideal for large components requiring fixtures or a large volume of smaller parts.

MODELS VT-77 — 75
(7 and 5 cu. ft. capacities)
Efficiently deburrs and finishes parts in quantities suitable for medium size production runs.

MODELS VT-72 — 71
(2½ and 1 cu. ft. capacities)
Popular unit for firms requiring precise finishing of a wide variety of parts in small lots.

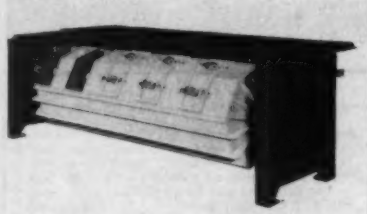
MODEL VT-70
(3 Quart capacity)
Bench model ideally suited for miniature bearings, extremely small gears, stampings, etc.

WORLD'S LARGEST LINE OF PRECISION FINISHING EQUIPMENT



ADVANCED DESIGN SERIES
Thirteen models are available in this series featuring capacities of from 5 to 40 cu. ft., each equipped with variable speed drives. (Infinite from 6 to 30 rpm's.)

SPINDLE MACHINES
Designed for fast precision finishing of complex, high quality components such as gears, bearing cages, spline shafts, rotors, on continuous production "in line" basis.



CUSTOM DESIGN BARRELS
Special large diameter barrels are available to accommodate extra large parts. Fixtures hold parts to assure complete, precise finishing of all crevices and surfaces.

SEND FOR NEW ALMCO CATALOGS ON BARREL FINISHING MACHINES MEDIA, AND COMPOUNDS

ALMCO

PRECISION FINISHING

Queen Products Division • King-Seeley Corporation

51 E. Main Street, Albert Lea, Minnesota

RE-BUILDING
at its Best

Two of Miles 25 year men scraping in a grinder bed to new tool tolerances—one of the many operations which make Miles rebuilt tools perform like new.

AUTOMATIC, 1" RAG Acme Gridley six spindle
AUTOMATIC, 1½" RAG Acme Gridley six spindle
AUTOMATIC, 2" RBG Acme Gridley six spindle
AUTOMATIC, 2⅝" Cammatic 8 spindle (3)
BORER, Model DB|212 Ex-Cell-O 2 spindle dbl. end
BORER, 6 spdl. No. 62 Ex-Cell-O cylinder
BROACH, 6 ton 38" stroke Model VA2 Colonial
BROACH, 10 ton 60" stroke Model XD Oilgear dbl. slide, vertical
DUPLICATOR Pratt-Whitney Model BL2416, 3 spindle
DRILLS, MULTIPLE 92A Natco "Helesteel" hydraulic
DRILL, MULTIPLE, 4BL Natco hydraulic
DRILL, RADIAL, 4'-15" column Cincinnati-Bickford super service '45
DRILL, RADIAL, 5'-13" col. Cincinnati-Bickford, Super Service, new 1943
OIL GROOVER, Wisco continuous, new 53
GEAR SHAPER, No. 7A, Model 7125A Fellows H.S.
GEAR TESTER, No. 13 Gleason Universal
GEAR GENERATOR, No. 5B Farrel/Sykes/Birmingham, late (3)
GRINDER, CENTERLESS, No. 12 Landis, Microsphere bearings, new 60
GRINDER CYLINDRICAL, 8"x18" Cincinnati type ER Filmatic
GRINDER, CYLINDRICAL, 18"x24" Landis type CH universal, new 47
GRINDER, DISC, No. 115—15" Gardner double end opposed
GRINDER, INTERNAL, No. 72A3 Heald Sizematic swivel headstock
GRINDER, INTERNAL No. 72A5 Heald hydraulic plain, swivel head
GRINDER, INTERNAL, No. 24-38 Bryant hydraulic table
GRINDER, SURFACE 8"x24" No. 35 Callmeyer & Livingston hydraulic
GRINDER, TOOL & CUTTER, Cincinnati Monoset
GRINDER, THREAD, No. 35L Ex-Cell-O universal, precision, hydraulic

CONTRACT REBUILDING OR RETOOLING OF YOUR MACHINERY. PLEASE WRITE TO US.

OVER 1,000 NEW AND USED MACHINE TOOLS IN STOCK
WRITE FOR LATEST STOCK LIST

MILES MACHINERY COMPANY

2039 EAST GENESEE • SAGINAW, MICH. PL. 2-3105

CIRCLE 601 READER SERVICE CARD

IMMEDIATE DELIVERY

2—#5 MINSTER HIGH SPEED O.B.I. BLANKING PRESSES, 45 ton, Flywheel type, 1½" stroke, 5 HP Varidrives, Speed range 150-300 SPM. Equipped with #4-6 Perfecto Double Roll Feed and Scrap Cutter. Never used. PRICE: F.O.B. East Boston ..... $11,076.00 each

2—#6 MINSTER O.B.I. PRESSES, 60 ton Geared type, 7" stroke, 12" shuthoight, 7½ HP Varidrives, 40-80 SPM. Never used. PRICE F.O.B. East Boston ..... $9500.00 each

WIGGLESWORTH MACHINERY COMPANY

60 Border St., East Boston, Mass.

CIRCLE 602 READER SERVICE CARD

BRAKES PRESSES SHEARS

Will Lease or Furnish Long Terms

JOSEPH HYMAN & SONS

2600 E. Tioga St., Philadelphia 34, Pa.

CIRCLE 603 READER SERVICE CARD

SEARCHLIGHT SECTION
ADVERTISERS' INDEX AND BUYERS' REFERENCE

Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name indicates the products or services offered by the advertiser.

3. Automatics
7. Boring Mills
8. Broaching Machines
10. Centering Machines
11. Chucking Machines
13. Cranes
17. Drilling & Reaming Machines
20. Fabricating Equipment
24. Furnaces & Ovens
25. Gear Cutting Machines
26. Grinding Machines
28. Honing & Lapping Machines
30. Keyseaters
31. Lathes
32. Liquidating & Appraising Plants
33. Machine Tools
37. Milling Machines
38. Miscellaneous
40. Oil Groovers
42. Planers
45. Press Brakes
46. Presses
47. Punches
53. Saws
56. Shapers
57. Shears
66. Welding Equipment

ADVERTISER	Page No.	KEY TO PRODUCTS OR SERVICES
Cincinnati Machinery Co.	142	7, 11, 17, 26, 31, 42, 47
Cook County Machinery Co.	142	20, 33
East Lehigh Ordnance Plant	141	7, 10, 13, 17, 24, 26, 31, 37, 38, 42, 46, 53, 56, 66
Eastern Machinery Co.	142	7, 26, 28, 31, 37
Hyman & Sons, Joseph	140	45, 46, 57
Midwestern Machinery Co.	142	3, 17, 25, 26, 31, 32, 37, 46, 53, 56, 66
Miles Machinery Co.	140	3, 7, 8, 17, 25, 26, 28, 30, 31, 40
Twist Drill Sales Co., Hayden	142	17
Wigglesworth Machinery Co.	140	46

SEARCHLIGHT **Equipment Locating** SERVICE

"No Cost or Obligation"

This service is aimed at helping you, the reader of "SEARCHLIGHT," to locate rebuilt and used machine tools and equipment, not currently advertised. (This service is for USER-BUYERS only.) No charge or obligation.

How to use: Check the dealer ads to see if what you want is currently advertised. If not, send us the specifications of the equipment and/or components wanted on the coupon below, or on your own company letterhead to

SEARCHLIGHT EQUIPMENT LOCATING SERVICE
c/o American Machinist/Metalworking Manufacturing
Classified Advertising Division, P.O. Box 12, N. Y. 36, N. Y.

Your requirements will be brought promptly to the attention of the equipment dealers advertising in this section. You will receive replies directly from them.

Searchlight Equipment Locating Service, c/o Classified Advertising American Machinist/Metalworking Manufacturing, Box 12, N.Y. 36, N.Y.

Please help us locate the following equipment:

.....

.....

.....

NAME .....

TITLE ..... COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

1/9/61

LIQUIDATION EAST LEHIGH NAVAL ORDNANCE PLANT

Applebutter Road, Bethlehem, Penna.

MACHINE TOOLS • FORGING EQUIPMENT • FURNACES • HEAT TREATING

MOST EQUIPMENT USED ONLY TWO YEARS OR LESS

BLOWERS
7—Allen Billmeyer 100 CFM. Turbo, 50 HP
5—Clarage No. 2½, MD., 30 HP
20—G.E. 450, 10,000-3000 CFM, A.C. Motors
9—Spencer Turbo, 2000 CFM

BOILERS
2—B&W 4000 HP., Type F 225 PSI, 475°F., 150,000 lbs./hr.. oil and pulverized coal, all aux. equip.

BLAST CLEANING EQUIPMENT
1—American Pressure Blast Cabinets, Dust Collector
1—Pangborn Type ES—140 Air Blast Cabinet
1—Pangborn Type ES—141 Airless Rotoblast Cab.

BORING MILLS, HORIZONTAL
Moline 4" Hydraulic Floor Type 3' x 10'

BURNERS—FURNACE
50—Hauck #782
525—Duradiant #670
75—Hauck Atomizing #790
125—Hauck #668
500—Hauck #700
100—Hauck #780

CENTERING MACHINES
3—Frew Centering Machine Hydraulic
1—Stoker Simplex 3U

CHARGING MACHINES—MANIPULATORS
3—Brosius 6,000 lbs., Auto. Floor on Rubber Wheels
1—Brosius 15,000 lbs., Auto. Floor on Rubber Wheels

CRANES—HOISTS
93—500 lb. Sheppard Niles Electric Hoists, Plain Trolleys, D.C.
45—4000 lb. Sheppard Niles Electric Hoists, Motor Driven Trolleys. D.C.
75—24' & 20' wall type jib cranes for above hoists
15—Pillar type jib cranes for above hoists, 12' to 18'
20—500 lb. to 10,000 lb. electric hoists
10—G.E. radial hoists for handling hot forgings

DRAW BENCHES
5—Bethlehem 100 ton, 11'6" stroke, hydraulic

DRILL PRESSES
Barnes Model #210, Box column, P.F.
Demco ¾" HI speed sensitive single spindle

DUST COLLECTORS
No. 20 Rotoclone Type D—Exhauster Collector

FLOOR PLATES
12—10'x14'x26"—50 000 lbs. each
1—12'x40'x26"—190,000 lbs.

FURNACES—HEAT TREATING—LEAD POTS
10—Carbottom Furnace 14'x50'
2—Flame Hardening 12'x15' with gas trans. system, Mixing Machine and After Coolers
1—Bung top heat treating furnace, 14'x108', including Pyrometer, Seal Plates and Blowers
10—14'9"x18' hearth type Reheat gas or oil
2—Mahr Double Chamber Oil Fired Forge Furnaces
3—Mahr #415 Steel cased and insulated oil fired
1—Gas Fired Die heating furnace
10—Bung top heat treating furnace, 11'x40'
10—G.E. Single Compartment intermittent conveyor type electric 8'x45' with pushers and shoes
10—G.E. Lead Pots 36"x72" with Radial Hoists, 18" grabs, 42" hydraulic lift electric trolley
4—General Electric RB-24 Box type electric furnace
6—Oil or gas fired draw furnaces
4—Oil or gas 10'x12' 10" annealing or forging
4—Oil or gas fired, bung 9'x12' for heat treating or forging
6—Bell bung top heating, blowers and controls, gas or oil
4—G.E. Rotary furnaces complete with charging, discharging and control equip., auto., 20' dia.
8—G.E. single compartment conveyor type draw furnaces 8' wide, 12'5" long x 15" double door
4—Dip tanks 9' long x 4' wide x 3½' high
12—G.E. Conveyor type single compart. heat treating furnaces, 8'x13'5"x15", double door
1—G.E. PRB #18 Box Type Electric
2—Electric solder heating pots
5—Salem oil or gas rotary forge or heat treating with charging and discharging tongs, conveyors
1—Type H. Salt Bath furnace complete
1—Type P Salt Bath furnace complete
3—Vertical Air Draw furnaces

GRINDER—PLAIN
4—Fitchburg 10"x48" model B hydraulic
2—Norton 10'x48"
1—Norton 24'x96"

GRINDERS—TOOL AND CUTTER
8—Bridgeport 4½ wet tool grinder, 30" Blount 30" wet tool grinder
2—Ex-Cell-O #46 double end carbide Ex-Cell-O #49 heavy duty double end carbide
2—Cincinnati #2 Universal, tool and cutter
1—S-U Hisey Wolf, 3 HP double end pedestal Boggis 700 tap grinder
2—Seller 4T universal tool bit 6" Hammond double end pedestal 4" Hammond double end carbide, M.D.

GRINDERS UNIVERSAL
2—Landis 14"x72" type C hydraulic—Internal
2—Norton 14"x72" type C hydraulic—Internal

GRINDERS—MISCELLANEOUS
Ex-Cell-O 35L Universal Thread
LG2 Stow Flexible shaft grinder pedestal

HAMMERS
2000 lbs. Erie Double Frame Steam Forging
6000 lbs. Chambersburg Steam Double Frame Forging
8000 lbs. Chambersburg Steam Double Frame Forging

LATHE—AUTOMATIC
Fay 12"x21", front and back slide, 12" 3-Jaw chuck
Sparks semi-automatic hydra-feed. 21"x52"
B&B semi-automatic hydraulic, 12"x36"

LATHE—BORING, CENTER DRIVE
1—Niles 47"x33'4"x33'4", dbl. end hollow spindle
9—Wicks 30"x25'x25', double end hollow spindle
2—Hepburn band turning, 14'x24", M.D.

LATHE—ENGINE
American 24"x72", geared anti-frictin tracing, H.D.
American 24"x101", geared anti-friction. M.D.
4—American Pacemaker 20x48, profile Att., Timken
1—LeBlond 20"x120", Timken, P.R.T., taper
2—Niles 30"x108" Time Saver, anti-friction P.R.T., —tracing.
2—Niles 30"x120" Time Saver, anti-friction, P.R.T. —taper.
Mackintosh-Hemphill 60"x60", anti-friction P.R.T.
Mackintosh-Hemphill 94"x30", P.R.T. Anti-Friction
2—Monarch 27"x60" Model N, Timken sizing
Monarch 24"x60" Model N, Timken tracing
Monarch 27"x108" Model N, Timken
Sydney 30"x84" Herringbone anti-friction taper
7—Simmons 48"x20' Herringbone—profile Att., P.R.T.
Sommerfield 52"x76' Timken—2 carriage, P.R.T.
Sommerfield 60"36' hd., Timken—2 carriage, P.R.T.

LATHE—BORING & TURNING
Sommerfield 50"x60', Timken screw cut.—P.R.T.
Sommerfield 50"x76', Timken screw cut.—P.R.T.
Sommerfield 50"x80', Timken screw cut.—P.R.T.
2 Betts Bridgeford 60"x80', 2 carriage, P.R.T.

LATHES—TURRET
3—3A—Warner & Swasey chucker—6¼ hole
3A—Warner & Swasey bar and chucking 6¼ hole
8—4A—Warner & Swasey, 9" hole chuckers
3R Gisholts chucker, 5¼" hole
3—3R Gisholts chucker, 5¼" hole screw cutting
4—4R Gisholts chucker, 9½" hole
2—4R Gisholts chucker, 9½" hole screw cutting
1—4R Gisholts chucker, 9½" hole 6' long screw cut

LIFT TRUCKS
1—6000 lbs. Yale K41 center control ready power
5—10.000 lbs. Yale low lift ready power

MILLER TREAD
—Hall Style D planetary
2—Hansen & Whitney—10x48
2—Lees Bradner—12x24 HT
3—Smalley General #27, M.D., Internal

MILLING—MISC.
2 Root. 3 Way Automatic with 3 verticals, M.D., paced 120 degrees apart auto. cycles

MILL
Salem Witter 5' Tube Processing

MOTOR GENERATORS—
Westinghouse (1) 125 HP; (1) 100 HP; (1) 75 HP; All 220 variable voltage

PLANERS
4—Mesta 6'x35' Post
2—Mesta 14'x35' Pit

PLATE HARDENING
Plate hardening furnace, 12'x15' gas transmission system mixing machines, after cooler, Spray quench water 12'x30'

PRESSES—HYDRAULIC
400 Ton Bethlehem, 4 post down moving bed 95½x 45", Stroke 42"
300 Ton Wilson Forging Press, six position turret type Ram Head, 2 work holder auto. load and unload
2—400 Ton United down moving 3 rod forging, 100" dia., turret indexing 4 pos. bed, stroke 48"
1,000 Ton Watson Stillman straightening—four rod type — bed 86x72 — Ram 42"x72" — Stroke 48" with traveling bed and work rotators

6,500 Ton Mesta Down Moving 4 rod self-contained forming — bed 15'x15'—Ram 7'6"x16'—Stroke 60"—Daylight 84

PRESSES—STRAIGHT SIDE—GAP FRAMES
56½ Toledo single crank tie rod fly wheel—135 tons
207½ Bliss single crank tie rod trim side shear—235
1—509 Bliss geared tie rod single acting 415 tons—for billet breaking—aut. load and unload

PRESSURE VESSELS
4—A. O. Smith Hypro-pneumatic accumulators 2,400 gallons at 2865 PSI, 42" LDx23' 3" SS x3-13/16

PULVERIZERS
2—B&W Ring Roll, 35 ton/Hr.
1—Jeffrey 24"x20" Rotary ring crusher, 70 HP

PUMP
LaBour size 25 type DPL, 200 GPM, 10 H.P.
2—Byron Jackson vertical deepwell type 8K centrifugal, 6000 GPM, 300 HP
2—Pennsylvania, 500 GPM, 30 HP. centrifugal
2—Dravo single stage double suction centrifugal
3—Byron Jackson 1½" BNL Bilton pumps
2—GALV 1500 GM Ingersoll Rand
5—Bethlehem 450 GM Triplex, 2500 PSI, 800 Syn. HP.
5—Worthington, 300 Syn. HP, 2500 PSI, Triplex

QUENCHING EQUIPMENT
Circulating quench tanks with conveyor
Circulating tanks with manual handling equip.
Handling equipment for oil, water, brine
General Electric spin quench oil, water, brine
Rotating quench boshes

SAWS
8—Marvel 9H High Speed heavy duty
3—Newton 32" heavy duty hydraulic
2—Racine 33-CX 12"x16" hydraulic shear cut

SHAPERS
2—24" Rockford Hydraulic Universal
1—24" Steptoe Heavy Duty Universal

STACKS AND FLUES
5—Ind. Heat Flues; Stack 4' I.D. x 107' ceramic

TABLES
2—Die Turn Tables 21"x26"
Billet transfer table with roller table
3'8" roller table

TANKS
1,000 gallon gasoline with Bennet pump
13—Water, Oil Sludge, Dip Tanks

TESTER
Bethlehem Pull Tester
Gogan—Model 1618 and Model-330 Brinell
Tinius Olsen No. 2 Standard
4—Shore Model C Sclerescope
2—Shore Model C-2 Sclerescope

TIRE SETTERS
4—West Hydraulic Tire Setters capacity up 20"

TRANSFORMERS
1000 KVA AC 11000/440/220

UNIT HEATER
10—Crane Model 315 FBS. 1.500,000 BTU/HR
5—Webster Model 3995-4, Giant units

MISCELLANEOUS
2—16' Brassert Automatic self-cleaning water strainer; Jeffrey Coal Elevator; G.E. 70 H.P. D.S.-114, 3600 RPM Steam Turbines; 6—18" Westinghouse Search Lights; Tyman daters; 2—75 ton Morgan turning riggings, lifting rig and hooks and chain; 2—150 ton motorized transfer cars and track; 1—Model 804-2150 air reduction travograph with magnetic tracing device and table complete with 8 radiograph burners; 29 — Pyrometers: Testing Cradle; Concentricity Gauges; Fairbanks model No. 1170—1,500 lbs. scale; Uo-Ending machines; Roll over stands; Shell lifter; 40—30" Buffalo type man coolers; 5—Ross 900 sq. ft. vertical oil coolers; Soldering rack and pot; Devilbiss spray painting unit; Electric solder units; Borescope 20' x 1¾" with retriever; 12" x ⅞" with retriever; Slug Plier; Spray Pipe and mast; Machine Vises 4-6-8"; Copper oxide battery charger; 3-6" Sheffler-Gross No. 930 Syiphone temp. regulators; 3—500 lb. Double Rated Airco Acetylene Generators; Lifting Tongs 6" to 16" Auto. and Chain; Chip Boxes; Circuit Breakers; Tote Boxes; Gas Converters; Detroit Degreaser Model 325; 5—Hydraulic Descalers up to 16" Billet; Turret Lathe Tooling; Atlas #25 Arbor Press; Storage Cabinets and Bins; 1500' Matthews 10' Section Roller Conveyor; Monorail 6"x10" Beam; 3—1400' Overhead Conveyors; Fire Brick.

MACHINES AT OTHER LOCATIONS:

1—LAKE ERIE 75 Ton, 100" Stroke, Draw Bench
1—80" ESPEN LUCAS Cold Saw
3—KEARNEY & TRECKER 5 H Plain Milling Machine, Vertical Heads
2—KEARNEY & TRECKER 4K Vertical Mill
2—BARNES Center Col. Inverted, 5 spindle, 6 Station Drill
1—165 TOLEDO Double Action Toggle Press, 125 Tons
1—1200 KVA Flash Butt Welder, 850,000 lbs. Upset, 303000 Amps
1—4A WARNER & SWASEY Ext. Long Bed, 8" hole, 4 Jaw Chuck, Threading and Taper Attachment; Tooling.
1—560T GIDDINGS & LEWIS 6" Bar Table Type Horizontal Boring Mill, High Speed Spindle, New 1948.
1—16 x 168 CINCINNATI Model 0M Plain Grinder, 1946.
3—BULLARD Cutmaster 74", 54", 36" Side Heads Chucks, All 1946.
1—BULLARD 30" Man-Au-Trol with Side Head, New 1950.
1—36" ROCKFORD Hydraulic Openside Shaper Rail & Side Head, New 1949.

Contact: Mr. Rankin Johnson, Jr., P.O. Box 1216, Bethlehem, Penna. Phone: UNiversity 5-0766

LURIA BROTHERS & CO., Inc. Sale Agents

EASTERN
Rebuilt Machine Tools
THE SIGN OF QUALITY— THE MARK OF DEPENDABILITY

- 4" bar 340 T Giddings and Lewis Horizontal Boring Mill.
- 30" Bullard Man-a-trol Vertical Boring Mill.
- 84" Cincinnati Hypro Vertical Boring Mill, A.C. model.
- 4'11", 4'13", 5'13" American Hole Wizard Radials.
- 24"x72" Landis Type F Plain extra heavy grinder.
- 36"x48" centers Landis Type CHW Universal Grinder.
- 42"x72" centers Norton Plain Grinder.
- No. 2A, and 3 Barnes Horizontal Hones.
- 25" raised in sand to swing 36" Monarch Lathes with tracer.
- 50"x41' centers LeBlond, two carriages, two tapers.
- No. 3 Cincinnati Dual Power, wide knee.
- No. 44 MB Smalley General Thread Miller.
- 28-60 Cincinnati Vert. Hydrotel with 360 degree tracer.
- 36—168" Cincinnati Vert. Hydrotel with 360 degree tracer.
- No. 4 Reed Prentice Vert. Miller and Die Sinker with tracer and depth control.
- No. 1A, 2A, 3A, 4A Warner & Swasey, some with hard ways.
- 8'19" Fosdick Radial mounted on moveable base.

THE EASTERN MACHINERY CO
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1-1241 CABLE ADDRESS EMCO

CIRCLE 605 READER SERVICE CARD

MACHINE TOOL LINES WANTED

Young, ambitious firm covering Northern N. J. and Southern N. Y. state is capable of handling one or two additional lines. Salesmen have thorough background in the application and use of machinery and tools; can prove a successful record of sales. Please address replies to:

GEORGE SHARP, INC.
HASBROUCK HEIGHTS, N. J.

CIRCLE 606 READER SERVICE CARD

Used by U. S. Armed Forces
MACHINE TOOL RECONDITIONING
4th printing
Write for free folder describing illustrated book.
MACHINE TOOL PUBLICATIONS
215 Commerce Bldg., 4th & Wabash Sts.
St. Paul 1, Minn.

CIRCLE 607 READER SERVICE CARD

"SEARCHLIGHT" IS
Opportunity Advertising
—to help you get what you want.
—to help you sell what you no longer need.

Take Advantage Of It
For Every Business Want
"Think Searchlight First"

'MIDWESTERN'
WE BUY & SELL
SINGLE MACHINES ENTIRE PLANTS
Over 200 Machines
In Warehouse Stock

AUTOMATICS
BRAKES
DRILLS
GEAR MACH'Y
GRINDERS
LATHES
MILLS
PRESS
SAWS
SHAPERS
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All 30 Day Guaranteed
With Return Privilege
WE LIQUIDATE And APPRAISE PLANTS

'MIDWESTERN'
MACHINERY COMPANY
2900 Pleasant Ave. S.
Minneapolis 8, Minn. • FE 8-7561

CIRCLE 608 READER SERVICE CARD

DECIMAL DRILLS
DRILL BLANKS
REAMER BLANKS in
Steps of .001"
HAYDEN TWIST DRILL SALES CO.
25205 Ryan Rd., Warren, Mich.

CIRCLE 610 READER SERVICE CARD

Cimco

- 60" x 60" x 16' Cincinnati Hypro Double Housing Planer, DC motor with AC planer M-G set, 4 heads, pneumatic tool lifters.
- 72" x 72" x 18' Cincinnati Hypro Double Housing Planer, new 1943, 4 heads, pneumatic tool lifters.
- 96" x 96" x 20' Cincinnati Hypro Double Housing Planer, 4 heads, pneumatic tool lifters, late.
- 6'13" column American Holewizard Radial Drill column extended 2', 32 speeds, late.
- 14' x 12' x 30' Betts Double Housing Planer, 50 HP DC motor, 4 heads, box table, ACTUAL PHOTOGRAPH AVAILABLE.
- 16" x 60" x 96" centers Norton Type "C" Cylindrical Grinder, two gaps, swing 40 x 20" in gaps, mechanical feed, late type.
- 22" x 24' centers Monarch Model CM Geared Head Lathe, actual swing 27½", 18 speeds, two Carriages, tapers.
- Model 300 Hanchett, 13 x 48" table, complete with magnetic chuck and rectifier late type.
- 24" x 72" Sidney G.L. late, 16 speeds, Timken bearing, taper attachment.
- 10" x 48" Thompson Hydraulic Surface Grinder, late type, AC motor.
- 4A Warner & Swasey Saddle Type Turret Lathe, 24" 3 jaw chuck, 9¼" hole in spindle.
- 5" bar Giddings & Lewis horizontal boring mill, table 52"x93", 12 speeds, outer support.

Cincinnati Machinery COMPANY
3901 Kellogg Ave., Cincinnati 26, Ohio
Phone TR 1-0853

CIRCLE 609 READER SERVICE CARD

OVER 300
Late Type
MACHINE TOOLS
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INDEX TO ADVERTISERS

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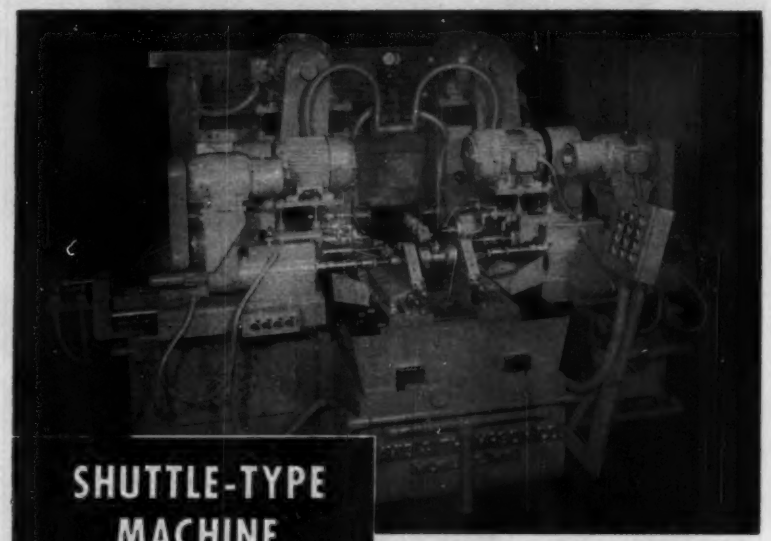
	Page
Air Express Div., Railway Express Agency	127
Allison-Campbell Div. American Chain & Cable Co., Inc.	130
Almco Queen Products, Inc. Sub. of King-Seeley Corp.	139
American Chain & Cable Co., Inc. Allison-Campbell Div.	130
Wilson Mechanical Instrument Div.	124
American Sip Corporation	3rd Cover
Anocut Engineering Company	120
Armstrong Blum Mfg. Company	12
Armstrong Bros. Tool Company	16
Bath & Co., Inc., John	35
Behr-Manning Co. Division of Norton Co.	37
Bethlehem Steel Company	102
Bliss & Laughlin Inc.	137
Braeburn Alloy Steel Div. Continental Copper & Steel Industries Inc	138
Brown & Sharpe Mfg. Co.	22-23
Bullard Company	48
Carborundum Co.	92
Chicago Screw Co.	104
Cincinnati Gilbert Machine Tool Co.	62
Cincinnati Milling Machine Co. Grinding Machine Division	5, 6-7
Cincinnati Milling Machine Co. Cincinnati Milling Products Div.	24
Circular Tool Company Inc.	126
Cities Service Oil Company	39
Clark, Cutler-McDermott Company	43
Cleveland Instrument Co.	136
Cross Company	20-21
Davis & Thompson Company	143
Detecto Scales, Inc.	145
du Mont Corporation	40
Dykem Company	136
Eastern Air Lines, Air Freight	138
Eisler Engineering Co., Inc.	122
Ex-Cell-O Corporation	56, 59, 60
Fellows Gear Shaper Company	8-9
Finkl & Sons Co., A.	41
Gisholt Machine Company	25-28
Goss & de Leeuw Machine Company	42
Grant Mfg. & Machine Company	136
Hardinge Brothers, Inc.	34
Hartford Machine Screw Co.	104
Heald Machine Co. Sub Cincinnati Milling Machine Co.	2nd Cover

(*Continued on page* 144)



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INDEX TO ADVERTISERS

(*Continued from page* 143)

	Page
Hughes Aircraft Co.	44
I B M Corporation Data Processing Div.	114-115
L & J Press Corporation	145
Landis Tool Company	10-11, 13
Leland-Gifford Company	146
Lempco Industrial Inc.	122
Lincoln Electric Co.	32-33
Loeffel Co., Inc., Arthur	17
Lucas Machine Division New Britain Machine Company	89, 90
Madison Industries Inc.	116
Manitoba Dept. of Industry & Commerce	136
McGraw-Hill Book Co., Inc.	38
Mechanite Metal Corp.	117
Minnesota Mining & Mfg. Co.	121, 123, 125
Morse Twist Drill & Machine Co.	50
New Britain Machine Co., The Lucas Machine Division	89, 90
Nicholson File Company	29
Northfield Foundry & Machine Co.	124
Norton Company	18-19
Pacific Industrial Manufacturing Co.	134
Railway Express Agency Air Express Div.	127
Randall Co., Inc., Frank E.	143
Republic Steel Co.	128-129
Ryerson & Son Inc., Joseph T.	54
Schrader's Son, A., Div. of Scovill Mfg. Co. Inc.	52
Simonds Abrasive Co.	46
SKF Industries Inc.	135
Snap-on Tools Corp.	118
South Bend Lathe Inc.	131
Standard Screw Co.	104
Starrett Co., L. S., The	94
Sun Oil Company	119
Textile Machine Works	132
Timken Roller Bearing Company Steel & Tube Div.	4th Cover
Vickers Incorporated Division of Sperry Rand Corp.	36
Vlier Engineering Corp. Sub. Barry Controls Inc.	133
Walker Turner Div. Rockwell Mfg. Co.	30-31
Warner & Swasey Company	14-15
Western Automatic Machine Screw Co.	104
Wilson Mechanical Instrument Division American Chain & Cable Co., Inc.	124

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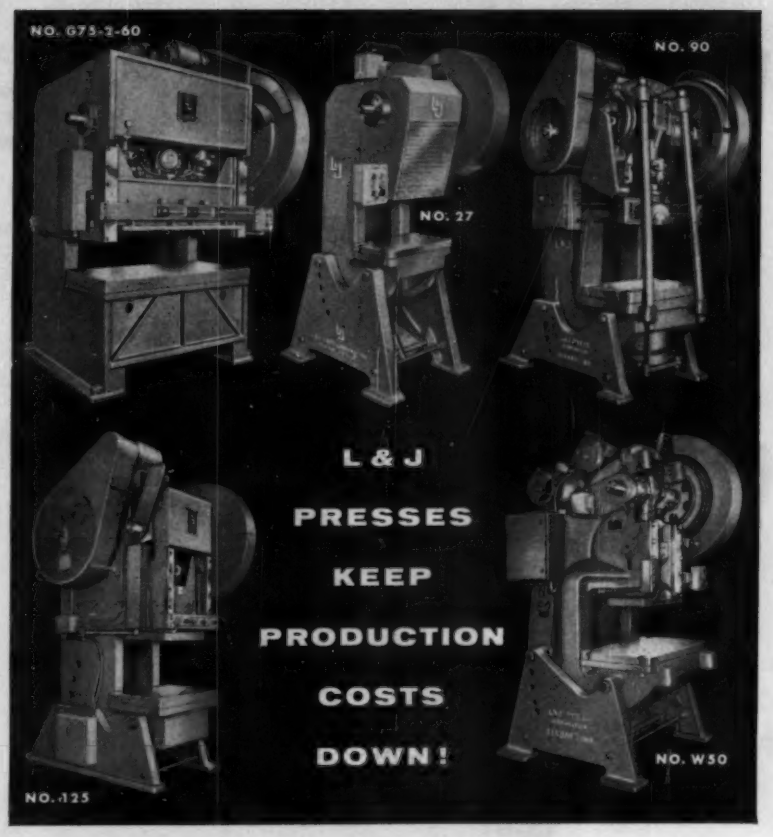

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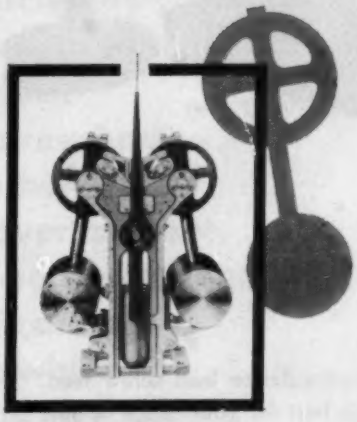

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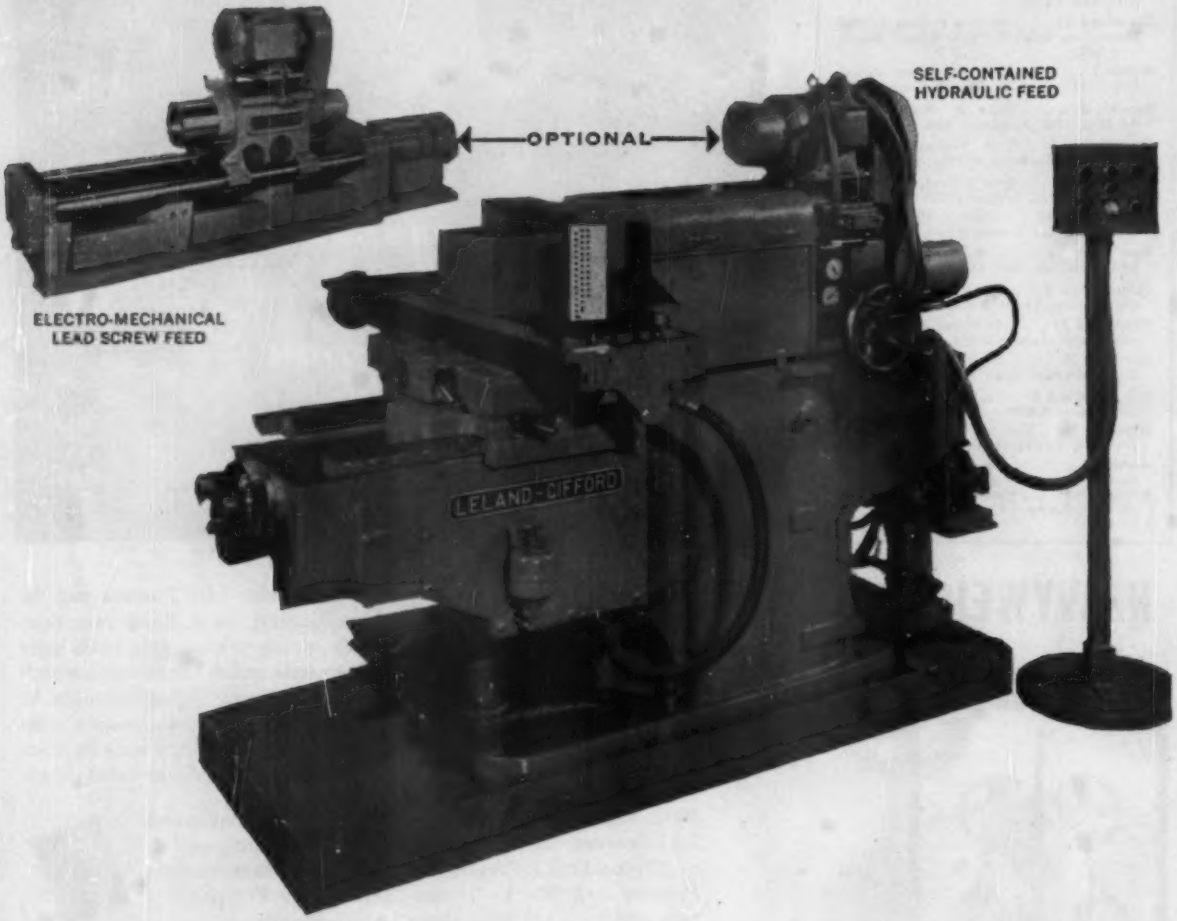

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51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77
78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103
104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124
125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145
146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166
167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187
188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208
209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224
225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245

ADVERTISEMENTS

246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266
267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287
288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308
309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329
330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371
372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392
393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413
414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434
435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455
456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476
477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497
498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518
519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539
540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560
561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581
582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600
743 744 745 746 747 748

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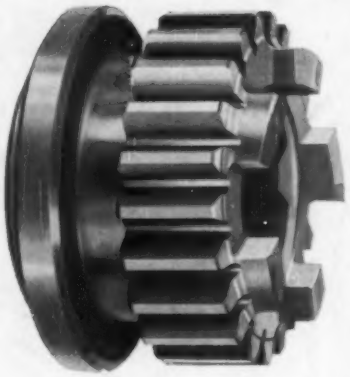

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